Taming Your 1040: TurboTax, TaxCut, Simply Tax

March 1994

PC Computing

CHICAGO UNVEILED!

Windows 4.0

Out with the Old

Plug and Pray
Adding hardware?
Better not try it alone.

Multi-Hassling
Running many apps?
You're all set to crash.

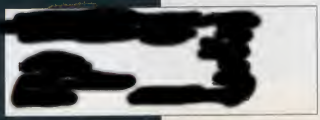
16-Bit Nag
Looming deadline?
Plan to spend all night.

In with the New

Plug and Play
One-step installation
locks and loads any device.

Multi-Tasking
Multiple threads keep
concurrent jobs on track.

32-Bit Racehorse
Tightly coiled code
clocks you out on time.



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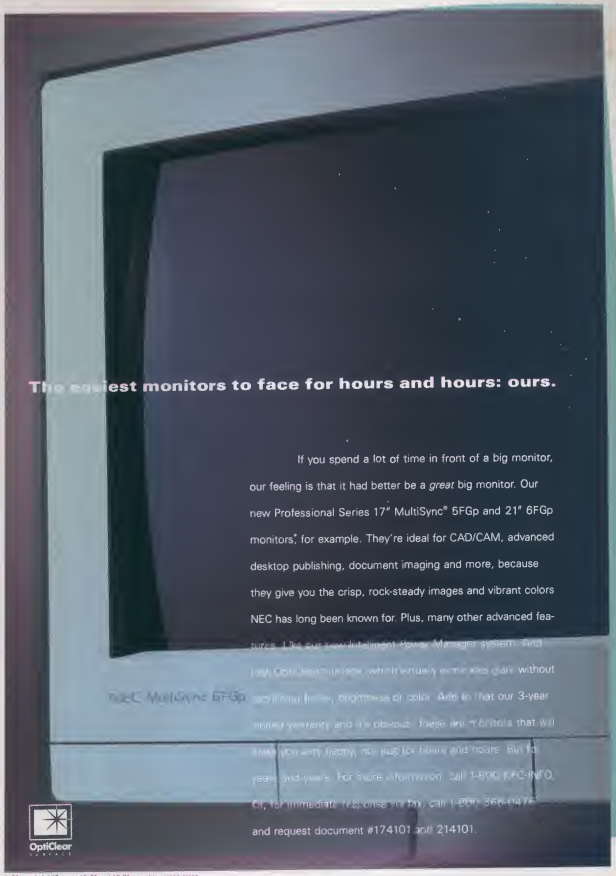

*17" and 21" CRTs yield 15.8" and 19.8" viewable screen areas

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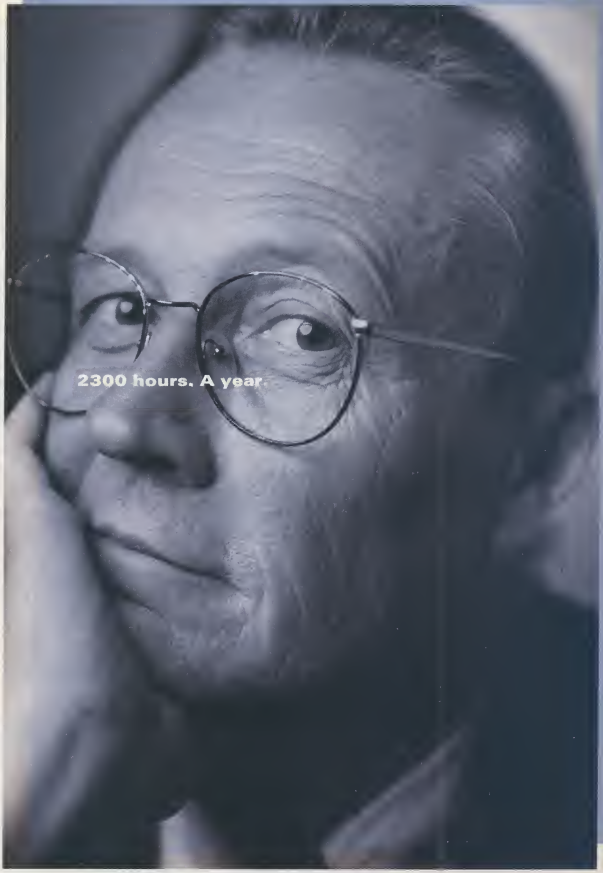
NEC

4 hours Monday, 6 hours Tuesday, 8 hours...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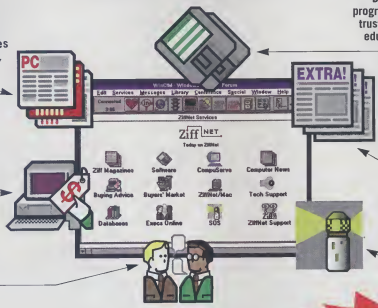

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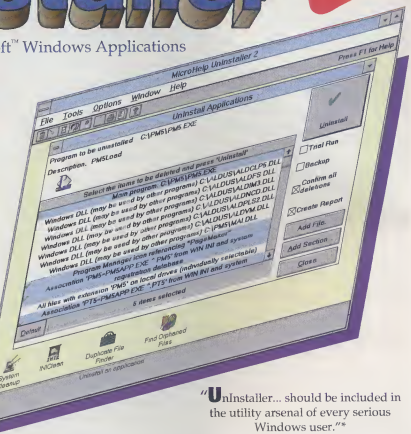

"UnInstaller... should be included in the utility arsenal of every serious Windows user."*

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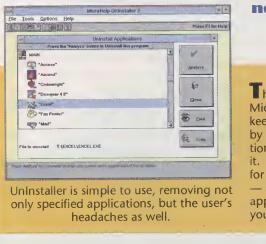

UnInstaller is simple to use, removing not only specified applications, but the user's headaches as well.

"MicroHelp has done an excellent job of designing a useful utility. The UnInstaller's operation is well thought out, successfully anticipating the things you want to do when you remove an application."**

This utility from MicroHelp can help you keep your Windows clean by removing an application and all references to it. It does this by looking for application fingerprints — places where the application has touched your system.

UnInstaller can even help network administrators remove applications from a network[1] server and all of the workstations on the network! When the administrator uninstalls a program, UnInstaller can leave a decoy copy of itself on the server, in place of the original program. When other users try to run the application from the network, UnInstaller offers to clean up their systems as well. This technology alone can save a network administrator many hours of work.

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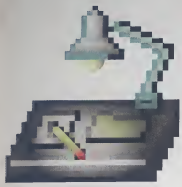

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Ed Bott

We've seen the future—and it works! Microsoft's blockbuster new version of Windows is chock-full of world-beating technology. Here's the inside scoop on the heart and soul of Windows 4.0. From plug and play to networking smarts, you're gonna love it.

142 Cutting-Edge Multimedia

Christine Grech, Matthew Lake, Wendy Taylor, and Ron White

Souping up your PC for today's sophisticated multimedia apps demands much more than a generic sound card and any old CD-ROM drive. Silky video and melodious sound require CD-ROM jukeboxes, monster monitors, and other state-of-the-art multimedia extras. We tested the best in each category.

160 Perfect Words

Kyla K. Carlson

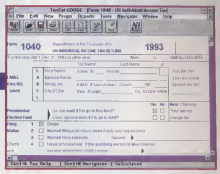
LAY-dees and GENT-lemen. Welcome to the Heavyweight Championship of the Word: WordPerfect 6.0 for Windows takes on Microsoft Word 6.0 for Windows. You're at ringside, and—phew!—what a slugfest. The latest versions of these word crunchers pack a much bigger punch than just a few trivial new features. When they faced off in our Usability Labs, the 15-rounder was fierce. Who won? How? The answers might surprise you.

188 Pssst! We've Got a Secret

John Bryan

It came together quietly, almost clandestinely—just like that. New standards and new products suddenly made digital signal processors a cinch to change the way you work and the way you buy computer products. Here's everything you need to know about how it happened, why, and what it means to you.

PAGE 32 IT'S TAX TIME. ARE YOU READY?



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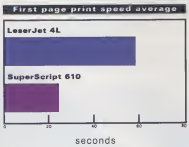

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Scan It! Edit It! Print It!

A dull black-and-white, bulleted text presentation won't pass the scrutiny of your colleagues, and it sure won't pass muster with your clients. You and your peers demand colorful, graphic images for any type of presentation, and you'll need the best high-resolution, state-of-the-art color products to produce it. So don't miss *PC/Computing*'s guide to capturing, editing, and printing eye-popping color images on your PC. We've reviewed the best new color scanners and printers, and tested top-of-the-line image editing packages to see how they fare at everyday graphics tasks.

Storage Blockbuster

Doubling your disk space and compressing your data won't solve all of your storage problems. Sooner or later your data will simply need more real estate. But don't just go with the latest trend—two years from now you could regret the drive you buy today. Find out how 23 market leaders fared under our exhaustive performance testing, and learn what steps you can take to make your next drive purchase a coup. Plus, get the keys to beating a slow data-transfer rate and learn how to speed up drive access time.

Also coming in April: Want to connect to the largest network on earth? Brian Livingston explains why the Internet is so great and how to get hooked in. Ever wondered how PKzip turns a 1MB graphics file into something you could fit into a thimble? Ron White and Timothy Edward Downs show how file compression works. And Jeff Prosise will tell you what Microsoft didn't about MS-DOS 6.2 memory management. Plus, bread-and-butter 486s, new digital cameras, and Internet access for PCs.

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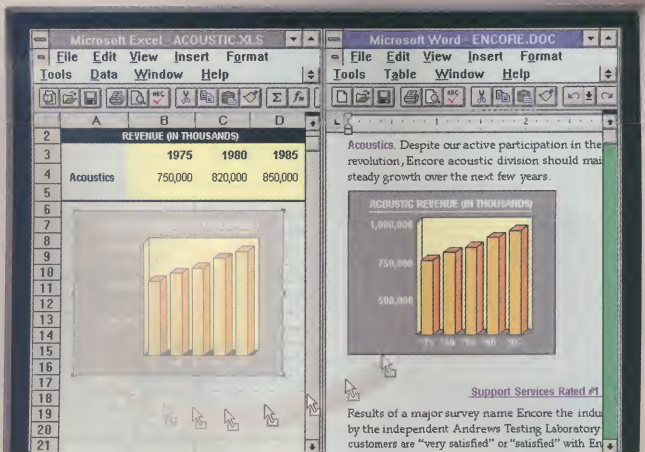

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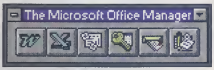

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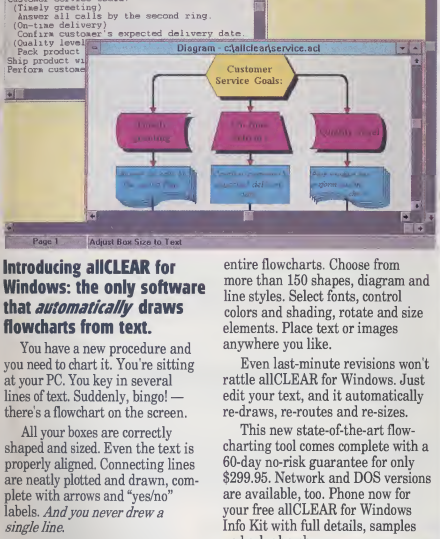

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*SRP. Note: Sound Blaster 16 MCD works with Sony CDU31A and CDU1A-00; Mitsumi CRMC-LU005s, -FX001 and -FX001D; and Panasonic CDR-523 and -563

PC Contact

This Month's Free Software and Shareware

All the public-domain and shareware programs and utilities featured in *PC/Computing* each month are available on our online service, PC/Contact, or on disk from Public Brand Software for a fee. Shareware requires additional payment to authors for continued use. Here's a sampling of the programs you'll find this month.

Clipboard Extender .....Windows, page 210
Tired of the Clipboard's single-item limitation? Put an end to the frustration of overwriting your Clipboard with this shareware utility. Instead of a holding a single item, Clipboard Extender holds several items at once. Need to remove one of those items? No problem. Clipboard Extender is editable. Download CLIPEXT.ZIP from PC/Contact's data library 3 (Utilities/Misc.).

Graphic Workshop.....Q&A, page 238
If you spend a lot of time scrolling around your subdirectories looking at files from the DOS prompt, you need a way to view PCX files without loading Windows. Graphic Workshop from Alchemy Mindworks does the job and a whole lot more. It can also convert, reverse, rotate, flip, scale, and crop your images. Give it a try by downloading GWSHOP.ZIP from PC/Contact's data library 3 (Utilities/Misc.).

BindDel.....Networking Smarter, page 246
Too many old objects cluttering up your Netware Bindery and slowing your tracking of security infractions? Wondering how you'll ever get rid of those unwanted items? Remove them with BindDel. BINDDEL.ZIP is available from PC/Contact's data library 3 (Utilities/Misc.).

HOW TO JOIN PC/CONTACT

Current CompuServe or ZiffNet members type GO ZNT:PCCONTAC at any CIS 1 prompt to access the PC/Contact forum. Cost is based on CIS's fee of $12.80 per hour for 1,200 and 2,400-bits per second and $22.80 per hour for 9,600 and 14,400-bps (these rates are lower if you're a CIS standard-plan subscriber).

ZiffNet users pay a monthly membership fee of $2.50. This support fee provides a variety of free and chargeable services. For information about these services, type GO ZNT:ZIFFHELP and download the files GOWORD.TXT and FREE.TXT from library 1 (General Information). For complete hourly rate information, type GO RATES while online.

If you're a new subscriber, follow these steps to join ZiffNet and participate in the PC/Contact forum activities:

1. Set the following modem and software parameters: 7 data bits, even parity, 1 stop bit, and full duplex.
2. Call CompuServe's toll-free customer assistance line at (800) 848-8990 (United States) or (800) 635-6225 (Canada). A voice-response system will ask if you want a local access number. If you do, you'll be asked for your phone number and the speed at which you wish to access the system, then you'll be provided with a local access number. From other countries, dial CompuServe direct at (614) 457-8650. If a local access number is available, the voice-response system will provide one, based on the country code in your phone number.

   You can also call CompuServe with your modem. Set your modem as instructed above and dial (800) 346-3247. Press Enter when your modem connects. Type PHONES at the HOST NAME prompt and press Enter, then follow the onscreen prompts to find an access number for your area.
3. Dial the access number with a modem. When your modem connects to the network, press Ctrl-C to get the system's attention.
4. At the HOST NAME prompt, type CIS and press Enter.
5. At the USER ID prompt, type 177000,5300 and press Enter.
6. At the PASSWORD prompt, type PC/CONTACT and press Enter.
7. At the ENTER AGREEMENT NUMBER prompt, type PCC94 and press Enter.
8. If you have trouble, call CompuServe Customer Assistance at (800) 848-8990. Immediately after you've followed the sign-on procedures shown above and provided CIS with your billing information, CIS will provide you with a new user ID (called a PPN) and a temporary password you can use immediately for participating in the forums and taking advantage of the services ZiffNet has to offer. Within a few days, CIS will send a confirmation letter with your new PPN and a new password. You can change your password at any time by typing GO PASSWORD at any CIS 1 prompt. Sign on with the new password and begin enjoying your ZiffNet membership.

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You can easily get all the public-domain utilities or shareware covered in this month's issue by calling the disk vendor Public Brand Software at (800) 426-3475 or (317) 856-7571. Ask for this month's Editors' Picks from *PC/Computing*. They're available for $5 or less per disk (most disks have several utilities and programs on them), plus $5 for shipping and handling. Visa and MasterCard are accepted.

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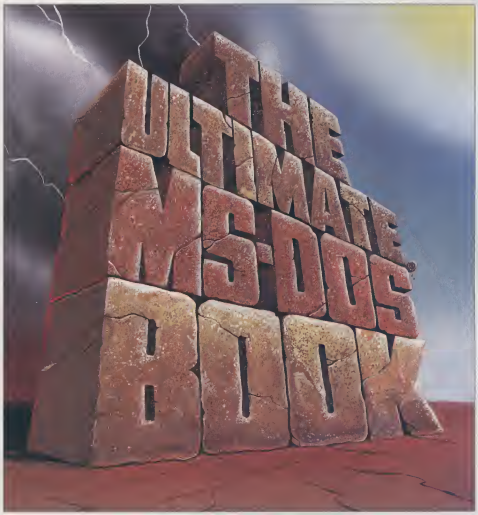

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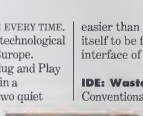
Reality Check: Why Do You Think They Call It Hardware?

CONVENTIONAL WISDOM WILL GET YOU IN TROUBLE EVERY TIME. That's especially true of PC hardware, where the technological landscape changes as often as a map of Eastern Europe.

While we've been waiting for the dawn of the Plug and Play era—when all our peripherals will come together in a harmonic convergence of Mac-like proportions—two quiet hardware revolutions have been taking place right under our noses. Think you know how to choose between SCSI and IDE for your next PC purchase? If you're relying on conventional wisdom, it's time for a reality check.



SCSI: Pain or Promised Land?

Conventional wisdom says SCSI is a jungle choked with technical thickets and overgrown with incompatibilities. Planning to install a new SCSI device? Conventional wisdom says you'll need a manual, a machete, a compass, and a bible. We'll send in a search party if you're not back within a week.

The reality is this: For most of us, SCSI is simple and straightforward. Getting a new SCSI device working is about as difficult as programming a VCR. Maybe easier. When you're done, you have a fast peripheral interface that lets you daisy-chain as many as seven devices without hunting down spare IRQs. Let's give credit where credit is due. Adaptec did what the PC industry should have done years ago, replacing the Babel of semicompatible SCSI standards with the Advanced SCSI Programming Interface (ASPI). You no longer have to hunt down a perfectly matched pair of proprietary drivers to make your SCSI adapter and scanner move together as smoothly as Fred and Ginger. Use the ASPI manager included with any modern SCSI card, and the ASPI-compatible device driver included with any modern SCSI device, and you can count on a perfect fit every time.

Life gets even easier when you use Corel's CorelSCSI. For $129, you can get a silky-smooth SCSI configuration program and all of the drivers you need to get most SCSI cards talking with most SCSI devices. (At $595, the LAN-savvy CorelSCSI Network Manager is the answer to a net administrator's prayers.) Corel should get the PC equivalent of the Nobel Peace Prize for making order out of the chaos that used to reign in this troubled region.

From a usability standpoint, the only pain in the SCSI process is termination. It's an unpleasant name for an unpleasant activity: The device at the end of the SCSI chain has to be physically capped off with a resistor pack. But sometimes just *finding* the resistor pack feels like a Mensa admission test—some SCSI peripherals use jumpers, some make you twiddle rotary switches, a few require a donglelike device that clamps between the SCSI connector and cable. It's still not a picnic, but SCSI is a lot easier than it used to be. So now that SCSI has proven itself to be fast, relatively easy, and compatible, it's the interface of choice, right? Not so fast. Here comes IDE.

IDE: Wasteland or Wonderland?

Conventional wisdom says the IDE interface is the hardware equivalent of Route 66—a charming two-lane highway that was useful in its day and is being left behind by the SCSI superhighway. An IDE card is the perfect place to plug in a cheap hard drive, says conventional wisdom. When you need a gigabyte (GB) of disk or a CD-ROM, you need a more powerful interface, preferably SCSI.

The reality is this: The Enhanced IDE interface has just arrived. It handles big hard drives, up to 8.4GB, and it lets you connect as many as four devices at once, including CD-ROM drives. It's the ideal choice for the general-purpose business PC, *especially* if it includes a CD-ROM drive.

Send your thank-you letters to Western Digital, which spearheaded the Enhanced IDE interface and the accompanying AT Attachment Packet Interface (ATAPI). The Enhanced IDE spec includes fast IDE ports for hard drives, and slower ports for CD-ROM and tape drives. In theory, at least, IDE devices using the new interface can achieve data throughput rates of 10MB per second, competitive with most SCSI systems.

New devices have already begun to appear. Conner Peripherals and Western Digital were first to announce drives built around the new standard, and it should be universally adopted by other hard drive makers this year. Last fall, Philips showed a prototype IDE CD-ROM drive that should arrive any day now, just ahead of a flood of competitors.

Best of all, Enhanced IDE adapters and peripherals should cost only a few dollars more than existing IDE hardware. In contrast, you can expect to pay a premium of at least $100 for the adapter when you cross the border into SCSI territory.

Changes in specs have helped define boundaries between IDE and SCSI

The Payoff

These quiet changes in the IDE and SCSI specs have helped to clearly define the boundaries between the two interfaces. For basic systems, with a hard drive of any size and a CD-ROM drive, go with Enhanced IDE. SCSI is essential for servers and systems that need many input sources. Bid farewell to the proprietary adapter cards that still come with some cheaper CD-ROM drives and scanners. And don't get complacent. This is, after all, merely new conventional wisdom. You can bet it will be due for another update by 1995—along with those 1994 maps of Bosnia-Herzegovina.

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intel inside pentium processor

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- On-board SCSI socket
- Two VESA local bus, five 16-bit and one 8-bit expansion slots
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- MS-DOS 6.2 w/Tools, Windows for Workgroups 3.11

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RUNNING WINDOWS WITHOUT NORTON DESKTOP? YOU PROBABLY SWIM AFTER A BIG MEAL AND THEN RUN AROUND THE POOL WITH SCISSORS, TOO.

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No doubt she would tell you to go right out and get the new Norton Desktop 3.0 for Windows before you damage yourself. Or your computer.

That's because NDW 3.0 not only enhances your work, it's also the safest way to run Windows short of tapping directly into Bill Gates' subconscious. Made by Peter Norton, it's packed full of utilities to provide a safer working environment.

Like our new Norton AntiVirus 3.0, which protects your system against over 2,300 known viruses, and our new Norton BackUp™ 3.0 with enhanced support for SCSI drives. There's also the new UnErase, to recover accidentally erased files. Disk Doctor for automatic disk diagnosis and disk repair. And a Fix-It disk with a full collection of DOS utilities to recover and repair files or entire disks, even if you can't run Windows. And now for the first time, you'll be able to run Speed Disk under Windows to boost performance.

In addition, NDW 3.0 simplifies Windows for you by integrating file and program management. And while the new FileAssist will allow you to easily manage your files without having to leave your applications, the new Day Planner will allow you to easily manage your life. And who doesn't need a little help with that?

Plus, the new "push button" Control Center allows you to customize pull-down menus, icons, toolbars and a lot more to make sure that Windows looks and works exactly the way you want it to.

So the choice is yours. Either see your local dealer, call 1-800-628-4777, ext. 9311 to order, or live a life full of danger and recklessness, running Windows without Norton Desktop 3.0 for Windows and sprinting around pools with sharp objects until you finally put somebody's eye out.

Of course, you would be absolutely crazy not to pick up your own copy of NDW 3.0 today. And remember, don't run Windows without it!

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MVP Awards: Readers Have Their Say

The customer is king, tech support responds, and Penn is defiled and defended.

Most Valuable Responses

I enjoyed your MVP Awards issue ("The Most Valuable Products of the Year," December 1993, page 188), but I was disappointed by your elimination of certain products because of their ship dates. Who wants an award when everybody knows that the award should've or would've gone to someone else? If a beta version of a program is good enough to be selected for nomination, then I see no reason why it can't win. As a longtime user of WordPerfect, I sure hope its win was legitimate and not because of Microsoft Word 6.0's ship date.

SHAWN MCGUINN
CALLAHAN, FLORIDA

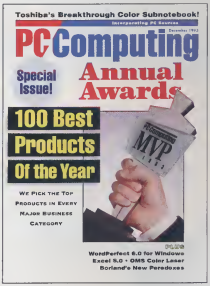
For a program to earn the Most Valuable title for a particular year, it has to be available and in use during that year. WordPerfect's win was obviously legitimate: it was out there being valuable in 1993—and it still is. —Editors

I protest the MVP Award to Intuit's QuickBooks 2 for Windows in the Financial and Accounting Software category. I have never before encountered such a disastrous, exasperating, and frustrating program as QuickBooks. Unlike Quicken, complexity—not simplicity—characterizes QuickBooks. *PC/Computing* is badly misleading consumers by giving QuickBooks an award.

JACK ALLEN
PACIFIC PALISADES, CALIFORNIA

We have a different take on QuickBooks: To us, it's like Quicken Goes to Business School. Unlike most high-quality financial software, QuickBooks doesn't lapse into impenetrable accounting-speak—and that can't be bad. —Editors

I see that a Microsoft *press release* ("The 100th Best Product? Microsoft At Work," page 272) takes the final spot in your MVP Awards list. This sort of mindless cheerleading on behalf of Microsoft creates the impression that *PC/Computing* is merely an adjunct of the Microsoft public relations machine. What I need from a computer magazine



is objectivity and healthy skepticism when it comes to a company's—any company's—products and claims.

MICHAEL REYNOLDS
ROCHESTER, MICHIGAN

You're right. PC/Computing *readers deserve objectivity and skepticism from editors and writers—that's what they get. The implications of Microsoft's At Work technology can't be ignored. The fax and bidirectional printer communication infrastructure alone is enough to raise all but the most jaded eyebrow. —Editors*

I read with some glee that *The 7th Guest* won an MVP Award for Education and Entertainment. But I was kind of bummed when I didn't see our name mentioned. Virgin Games is the distributor of *The 7th Guest.* Trilobyte spent almost three years designing, producing, managing, and actually making the product.

GRAEME DEVINE
PRESIDENT, TRILOBYTE

At Your Service

There's been a lot of news lately about the trend from free to fee-based support ("Boy Is It Tough to Find Good Help These Days," December 1993, page 46). All of the big publishers are starting to charge for what they used to give away free, and it's not surprising. What is the job of a software publisher, anyway? To develop software. Ours is the only industry where the consumer expects the manufacturer's warranty to last forever. We accept the planned obsolescence of our cars, but demand that our software continues to hum like it did when it came off the line—even though roads, gas, and weather have all changed dramatically.

KERA MARTIN
DIRECTOR OF MARKETING, SOFTWARE SUPPORT

Vendors develop their products for the customer, and to keep their customers, they must provide support. On the other hand, it's obviously the user's responsibility to operate the product. No one calls General Motors and asks them how to drive a car. Today's software and hardware are sophisticated tools. As an end user, you must learn to use those tools.

RICHARD W. HUNT
MISHAWAKA, INDIANA

Letters

Pay for technical support? That will have me buying from the competition.

GREG SINGER
HUDSON, WISCONSIN

There are no toll-free international calls, so even if support is free, users calling from outside the vendor's country must pay for the phone call, which is not cheap. Many software publishers do not have branches here in Brazil. Instead, sales are handled by distributors, who are under no obligation to give technical support. Why should we pay for support that is normally unavailable to us? Unbundle technical support from the price of the product and shift the cost to those who want it and can get it.

LUIZ EDUARDO GONCALVES GABARRA
RIO DE JANEIRO, BRAZIL

I work in tech support, handling from 30 to 50 calls daily. Some advice to users:

1. Make an earnest effort to find help in the documentation provided. Yes, many manuals could use some improvement, but try to familiarize yourself with the program before calling.

2. Take notes as the technician talks you through the problem. It's amazing how many people call repeatedly about the same problem.

3. Treat the technician with courtesy. An upbeat, friendly attitude will receive better support.

LENNY LOUKS
BATON ROUGE, LOUISIANA

Less than Perfect Review?

In your review, "WordPerfect 6.0 for Windows Does It All" (December 1993, page 70), you write, "Is there any serious reason not to get WordPerfect now? No way." How about the fact that 95 percent of PC owners can't use it because they don't have 8MB of RAM. They must spend $250 for more RAM to use the great features that simply do not work with 4MB. Indeed, page 936 of the WordPerfect manual states, "Performance may not be acceptable with only 4MB."

WILLIAM R. LANE
AUBURN, CALIFORNIA

With Windows programs in general, you should have at least 6MB of RAM. Sorry. That's just the real world today. My bottom line is that I wouldn't recommend a product I wouldn't use myself. I use WordPerfect 6.0 for Windows steadily for about six hours a day, and you couldn't pry it off my PC.—Ron White

Poison Penn

Contrary to his December 1993 column ("Billy Idol: Learning to Type in Cyberspace," page 506), Penn is not a cyberpunk. Penn is a first-rate magician, and maybe even fancies himself a computer whiz, but he is definitely not a cyberpunk. Penn is a nerd. Simply being a nerd doesn't make you a cyberpunk.

I think Penn should go back to writing

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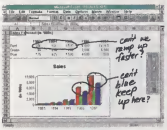

Shown above is handwritten annotation to a spreadsheet. Each member of a workgroup makes their annotations in uniquely colored ink. A pen is such a perfect complement to your keyboard, you'll probably never use a mouse again — in your whole life.

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Letters

columns about his Uma Thurman fetish and other cute stuff, without making himself out to be a rebel and a cyberpunk.

PHILIP REGER
FULLERTON, CALIFORNIA

I can't believe some of the diatribes against Penn's columns. If I don't find it funny, I don't have to read it. If I stand in the street and get hit by a truck, I shouldn't rant and rave about the dangers of trucks—I shouldn't stand in the street! If you don't want to be offended by Penn's humor, don't read his column.

PHILIP NEHRT
BARRINGTON, ILLINOIS

OS/2, Windows, Who Cares?

You will lose a subscriber if you don't start paying more attention to OS/2. I'm tired of the injustice being served to this wonderful operating system, which, according to your own Software Saleswire, is selling like wildfire. Instead, you maintain your Windows-biased ways. Those of us who use OS/2 need a magazine that will provide information we can use, such as tech tips and new product information. The name of your publication isn't Windows Computing, therefore you should cover all of the aspects of the PC world, not just Windows.

JOHN A. GRAWCOCK
KOKOMO, INDIANA

See our review in this issue, "OS/2 for Windows: Slimmer, Smarter, Still OS/2," on page 39. —Editors

My company supplied me with a PC with OS/2 preinstalled, and I installed my own Windows software. The machine crashed at least once a day, sometimes as many as eight times. Crash protection was a laugh; it would shut down one application after another, ending up with Program Manager. At that point there isn't much you can do but Ctrl-Alt-Del to reboot. Eventually, I removed OS/2 and installed DOS and Windows, and two weeks later I haven't had a single problem. Windows programs run much faster in Windows than they do in OS/2. Sorry, IBM, but for me, you blew it.

SIMON FARROW
VANCOUVER, BRITISH COLUMBIA, CANADA

I'm totally missing the point on operating systems. Commentaries in computer magazines are continually filled with techno-nerds proclaiming, "Windows is a dog," "Windows is great," "OS/2 is better," or "OS/2 is awesome." What's the point? Do these people actually boot Windows or OS/2 and say, "Ooooh, Ahhhh"?

For me, DOS has only two functions: to run a DOS-based game, or to run Windows. Windows has only two functions: to facilitate basic file-management, such as move a file, and to run an application.

I turn on my computer to use my applications. I don't turn it on to marvel at the operating system. Operating systems stay out of the way and I get my job done. What's with all this awesome-dog-great-waste-of-disk-space stuff?

CHRISTOPH L. HERD
COLORADO SPRINGS, COLORADO

PC/Computing has convinced me that I do not want to use Windows for my critical data because too many things can go wrong! I had the pleasure of having my system crash during a CPU and hard drive upgrade. The upgrade took place during several months, one component at a time, and then I spent more than 80 hours reconstructing my data.

OS/2 appears to be a real operating system, not an operating environment, like Windows. Windows is a bully and refused to be a peer on my hard drive. It corrupted and crashed many files, as error messages I'd never seen appeared. Data was lost. Windows is now gone.

MICHAEL W. KELLER
LANCASTER, PENNSYLVANIA

Correction

In January's review of Logitech's AudioMan (page 95), we misstated one of its features. The AudioMan is not compatible with Creative Labs' Sound Blaster. We apologize for the error.

Mail your thoughts to Letters, PC/Computing, *950 Tower Lane, 19th Floor, Foster City, CA 94404; fax us at (415) 578-7029; or contact us via MCI Mail at PCC Editorial or via PC/Contact, our online forum. Letters must be signed and must include a daytime phone number. All letters become the property of* PC/Computing *and will be edited for length and clarity.*

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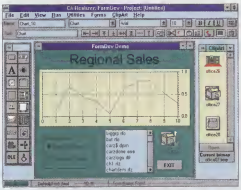

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Remember when color TVs suddenly became affordable? Can you say déjà vu?

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New!

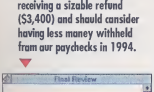
THE BEST TAX SOFTWARE IS GETTING BETTER

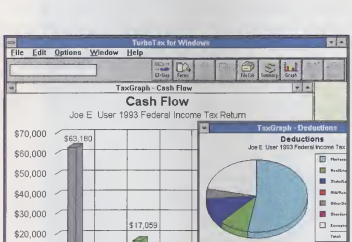
Keep More of What

ACCOUNTANT IN A BOX

Using ChipSoft's TurboTax Personal 1040 HeadStart is not quite the same as taking your taxes to an accountant—but it's close. The program has strong auditing features that find creative ways to save money and reporting utilities that provide quick graphs of income, deductions, cash flow, and tax owed for various tax scenarios. It's a useful tool for what-if scenarios.

TurboTax's Audit Flag looked at our large medical deduction ($3,500) and reminded us that we could deduct 9 cents per mile for transportation costs to and from the doctor. It also pointed out that we were receiving a sizable refund ($3,400) and should consider having less money withheld from our paychecks in 1994.





WHAT WOULD YOU rather do: prepare your taxes or visit the dentist? Not an easy choice. For a lot of us, tax preparation is tantamount to a root canal. And while the tax packages reviewed here will not keep you from getting drilled by the IRS, they can reduce your hours in the chair.

Most tax preparation programs will save you time by automating several steps: selecting tax forms, computing numbers, and filling out forms. More than that, advanced packages simplify the whole process of tax preparation, from organizing your shoe box of receipts through generating finished tax forms. Expert packages can even remind you of deductions you might otherwise overlook (see "Accountant in a Box," at left).

For this report, we used three top tax programs to prepare a relatively complex tax return. Our players: market-leader TurboTax Personal 1040 Headstart for Windows by ChipSoft, Andrew Tobias' TaxCut for Windows by MECA Software, and newcomer CA-Simply Tax by Computer Associates.

Of our three accountants in a box, we prefer TurboTax. It has extensive audit features and a library of more than 100 tax forms and schedules. TaxCut is a close second, thanks to its slick Navigator feature, which leads you step-by-step through the tax filing process.

We cannot stress enough the importance of strong audit features in a tax program. After all, it's better to do the math on your end than have some mean-spirited mainframe flag your return. TurboTax and TaxCut both win here. When we tried to print our completed return, TurboTax alerted us that one line on our Schedule C form was blank. Likewise, TaxCut told us that the amount of our charitable deductions was substantially higher than the average—a potential IRS audit flag. CA-Simply Tax's audit feature is less elaborate, but it does check your math.

TaxCut has a unique feature that lets you review all of your tax data entries in a single report, grouped by tax form number and line number. You can jump directly to the appropriate tax form if you want to see your numbers in context. In TurboTax and CA-Simply Tax, you have to page through all the forms and schedules to review your work.

Up to Speed

This year's crop of tax preparation software is easier to use and more thorough than ever. TaxCut's help screens are extensive and clear, but TurboTax offers the most flexibility and is the fastest to navigate if you are familiar with the flow of tax returns.

You Make

All three programs also let you enter data directly on IRS forms, or they can step you through an interview process. TurboTax and TaxCut pose these questions in plain English. CA-Simply Tax relies on a good deal of IRS technobabble to elicit information.

If you use a personal finance program, such as Intuit's Quicken or MECA's Managing Your Money, you can port that data to your tax program.

All three programs produce professional-looking, IRS-approved tax forms, plus all the auxiliary forms and schedules that comprise your return. TaxCut's forms printed the fastest, but TurboTax forms looked the best.

Graphic Analysis

Both TurboTax and TaxCut can create graphs that show how much income you had and how much tax you paid. But TaxCut has only one graph that shows all your tax summary information (gross income, total tax, or itemized deductions). TurboTax has that summary capability and also lets you view income, deductions, cash flow, and tax analysis in greater detail on separate graphs.

If you have only W-2 income and generally file a 1040EZ, you don't need tax software—although there are programs available for you. Tax programs do the most for individuals who itemize deductions and file multiple schedules, such as home owners or those who have income from a small business or investments. These programs are also good for evaluating different tax strategies; TurboTax, for example, has "what-if" capabilities that let you see the implications of, say, getting your bonus in December instead of in January.

This year's TurboTax offers the best mix of ease of use and attention to technical detail. It's just right for the seasoned individual who is looking for every possible deduction, wants to avoid mistakes, and is willing to invest a little more time to accomplish both goals. But go with TaxCut if ease of use and getting the return done quickly are most important to you. It's better for the tax novice.

CA-Simply Tax lacks the simplicity and completeness of the other two tax programs. What you save in money, you'll probably lose in time. Even for a $9.95 program (you have to pay only shipping and handling charges until April 15), that's no bargain.

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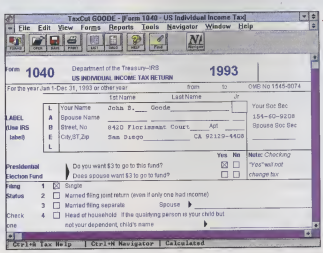


SMOOTH SAILING
Novice users will appreciate Andrew Tobias' TaxCut's Navigator, which divides complex tasks, such as proofing your tax return,

into easy steps.

When you're ready to check your return, the program first helps you review your data, then it runs the auditor, displays the filled-in forms, and gives you charts and graphs for the big picture.

This hand-holding approach makes TaxCut the least intimidating of the programs reviewed here.

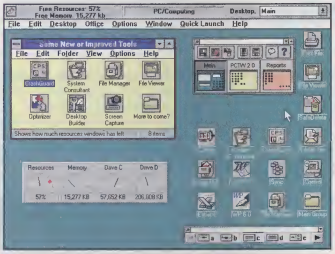
PC TOOLS EDGES OUT NORTON DESKTOP

How to Get the Most

A Clean Desk

At first glance, Central Point's PC Tools 2.0 for Windows' desktop looks very much like its well-received predecessor. The title bar can be configured to offer system resources information, date and time, an editable "office" name, and a drop-down MultiDesk desktop selector. The product's new graphical CrashGuard resource monitor and warning utility is the highly configurable gray desktop placard in the lower left corner.

The shell offers a lot of the same features as its competitor Norton Desktop, but there are differences. Norton doesn't have anything like MultiDesk, while PC Tools lacks an appointment book.



WHOPPER AND BIG MAC. Mustang and Camaro. Reebok and Nike. Some product rivalries, over time, assume mythic proportions. And consumers, caught in the crossfire of megadevelopment dollars and intense market research, walk away with the loot.

So it is with Central Point Software's PC Tools 2.0 for Windows, up against Symantec's Norton Desktop 3.0 for Windows. Mere weeks on the heels of the introduction of Desktop 3.0, a winner by all accounts (see "Hate Doing Windows? Try New Norton Desktop," February, New! page 32), Central Point has released the latest update of its already-great Windows shell.

Which is better? Our test drive of PC Tools places it ahead of Symantec's new Norton Desktop in several important ways.

For starters, Central Point offers practical solutions to the reliability and performance issues of Windows. Like Hewlett-Packard's Dashboard for Windows, the new PC Tools desktop provides a configurable resource monitor called CrashGuard that tracks system resources, memory, and disk usage.

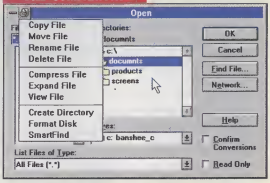
Guided Tour: The Best Desktop Yet?

PC Tools for Windows adds ease of use and reliability.

CrashGuard

CrashGuard may be PC Tools 2.0 for Windows' best new feature. You can configure it as small as a postage stamp, or much larger, bristling with information. Bottom line: You'll never again run out of system resources, disk space, or memory without warning.

File Companions



Simple, yes, but highly useful. The small File Manager icon appears on the title bars of common Windows-application file dialog boxes, offering commands to copy, move, rename, delete, compress, expand, view, create a directory, format, and file search.

out of Windows

CrashGuard warns you when resource availability falls into the danger zone, and its graphical status displays are configurable for size, position, and screen orientation.

PC Tools also makes optimizing your Windows installation a breeze. In the first version of PC Tools for Windows, the System Consultant feature served up detailed recommendations for fine-tuning your Windows setup. In Version 2.0, however, the Consultant can actually implement its recommendations.

Smart Folders

Norton Desktop 3.0 premiered a powerful Macintosh-like feature called SmartGroups, which lets you create program groups that are dynamically linked to your files. Create a file, and you have an instant icon. Central Point's version of this feature is its AutoSync Folders and Desktops. The idea is the same, but the implementation is different and better in PC Tools.

AutoSync Folders are PC Tools folders linked to one or more hard drive subdirectories. You specify any file extensions for which you want the folder to automatically build icons. Then you enter a drive path—or paths—to link the folder to. You can specify one or more directories, an entire drive, or even multiple drives. PC Tools automatically creates and maintains icons of the files and programs, whether you add or delete files from the desktop, applications, a file manager, or DOS. Having AutoSync Folders that span drives makes it easy to set up folders specific to applications. Another easy way to create AutoSync Folders is on installation of PC Tools: The shell will automatically build a folder for each of your applications (such as spreadsheet, word processor, and graphics editor). Finally, AutoSync Folders can be set (optionally) to have file deletion capabilities. Want to erase a file? Just delete the icon—no more two-step file management.

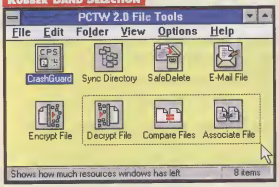
Norton Desktop introduced a great file-management dialog box that grafts itself into all your applications' File Open and File Save dialog boxes, allowing you to perform file management when you need to do it—when loading or saving a file. PC Tools has a similar feature, called File Companions. In this case, Norton Desktop outdoes PC Tools: Norton

Better Icons

Look familiar? Central Point's PC Tools 2.0 for Windows' pop-up toolbar-button labels work very much like Microsoft Word 6.0 for Windows' ToolTips. Pause the mouse pointer over any toolbar button for a split second, and up pops

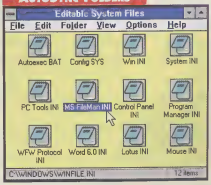
a label like this one describing the button's function. Combined with PC Tools' new, smaller icons, the label pop-ups markedly boost the usability of the product's toolbars.

Rubber Band Selection



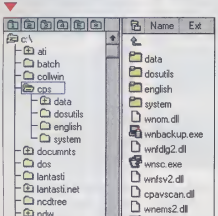
Windows users have always needed a way to select multiple icons in one swoop. Now, just drag the scalable line box around the icons you want to select, let go, and they're highlighted. It's easy and it saves a lot of time.

AutoSync Folders



Hunting down Windows' INI files is a whole lot easier if you can just display all your system files. The same idea works for READ.ME files, word processing documents, sound files, image files, macros, and so on.

FILE MANAGER
PC Tools 2.0 for Windows' File Manager is the best in the business. It's powerful, configurable, and easy to use. Added to features from



Version 1.0 are a new DOS command line; PKzip 2.x file compression; the capability to drag selections in the file pane and select all files (but not subdirectories); support for cut and paste in the File Viewer; and multiple-subdirectory branch sizes. Plus, the file pane's headers for name, extension, date/time, and size can be rearranged and resized for width. The utility makes it easy to see, sort, select, and manage files, no matter how small your display is.

makes more files available on your application's list of most recently opened files, for example. Nevertheless, both programs have improved their standard dialog boxes.

The Polished Desktop

Norton Desktop and PC Tools polish Windows' underlying desktop metaphor to a fine luster. And while Norton is good, PC Tools is better. The PC Tools desktop stores program size and positioning data, so that your application windows open in the same size and location every time. And PC Tools still has the handy MultiDesk feature that gives you multiple virtual desktops for different tasks. Norton lacks this highly useful feature, which is surprising since even the minimalist HP Dashboard matches PC Tools in this area.

PC Tools also has a unique, Windows NT-like "office" feature, which lets you set up different desktop configurations for different users of the same PC. Sharing a PC or a notebook from the company fleet is now much easier.

In the area of customizability, Norton has the edge, not for its feature set, but for ease of use. While PC Tools folders can be individually configured for icon spacing, background color, password, icon picture, and access rights, the absence of a Norton-like Control Center makes configuring the system somewhat arduous.

Like Norton, PC Tools is loaded with toolbars and right-mouse-button menus. With only a few logical exceptions, all major utilities, applets, and desktop structures have configurable toolbars with large or small color icons—the new, smaller icons allow you to fit more buttons on your screen. If you're prone to suffering from icon overload, PC Tools will push you over the edge. But fortunately it has new pop-up text labels, reminiscent of Microsoft Word 6.0 for Windows' ToolTips.

In the but-wait-there's-more category, you'll find second-generation versions of PC Tool's Optimizer and DiskFix. Both now support DoubleSpace compressed drives (though Stacker and AdStor drives are not supported), and both support larger-capacity disks. The Backup utility is now faster and offers new SCSI device support. Like Norton Desktop, PC Tools comes with a passel of utilities, including a virus scanner, a batch language, a dialog editor, a screen saver, an icon editor, an event scheduler, an undelete feature, and emergency-startup disk support. That's in addition to a new screen-capture utility, a DOS TSR manager, and CrashGuard. What's more, you can upgrade for $49.95 from a competitive product such as Norton Desktop, PC Tools 1.0 for Windows, or many other Central Point products.

Coke or Pepsi?

PC Tools 2.0 for Windows is an excellent desktop utility with few shortcomings. But you can say the same about Norton Desktop 3.0. When you compare their data protection and recovery tools, for example, both are excellent. But if you're already sold on the desktop metaphor, or if a better Windows File Manager is high on your list, there's a clear choice: PC Tools. The same is true if working with multiple desktops appeals to you, since Norton has nothing like MultiDesk. If smart folders sound cool (and they are), PC Tools wins out there, too.

The decision is tougher when you're looking for a bonanza of utilities. Norton Desktop has the edge with its full-blown Windows personal information manager, Windows text editor, and special-purpose calculators. PC Tools' screen-capture utility, configurable control panel, and handful of DOS utilities don't swing the balance. Check with your dealer, though, about a possible last-minute addition to PC Tools that might bring the package up to bonanza parity with Norton Desktop.

Both Norton Desktop and PC Tools are excellent products. PC Tools, however, is more excellent. **SCOT FINNIE**

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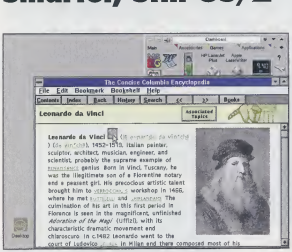
OS/2 for Windows: Slimmer, Smarter, Still OS/2



Fast and mostly compatible: OS/2 for Windows runs apps—like HP Doshboard—that don't work even on Windows NT. But it didn't support our CD-ROM drive until we downloaded a new SCSI driver.

OS/2 FOR WINDOWS? A crash-proof 32-bit operating system sitting on top of Windows 3.1, a heartbeat away from a general protection fault? As oxymorons go, this one's up there with *congressional ethics.* So let's cut to the chase: OS/2 for Windows is really OS/2 2.1, with every line of code and every feature intact. Nothing's been subtracted. OS/2 for Windows exists solely for its capability to hook into the copy of Windows 3.1 you already own. Think of it as OS/2 for Windows *users.*

If you regularly use Windows applications under OS/2, this is a must-have upgrade. OS/2 2.1—which is still being sold—handles Windows applications by maintaining its own Win-OS/2 code in a separate directory. The newer OS/2 for Windows eliminates this clumsy double bookkeeping.

Setup Blues

Give IBM two thumbs up, way up, for pricing the CD-ROM version of OS/2 for Windows at $139, $10 less than the floppy-disk version. But if your experience is like ours, you might not get to pocket the savings.

OS/2 for Windows initially wouldn't support the CD-ROM drive on two of our three test systems. After downloading the needed SCSI driver (which required a long-distance call), the rest of the installation went without a hitch. OS/2 for Windows installed flawlessly on our third system, a Compaq DeskPro 4/33i with a Future Domain 1650 SCSI adapter and Sony CD-ROM drive.

On the software front, we threw OS/2 for Windows a couple of wicked curves to test its compatibility, and we found no surprises. Almost all Windows 3.1 applications run perfectly in 386 enhanced and standard modes. But the rare applications that require virtual device drivers, like the tape backup utility in Central Point Software's PC Tools for Windows, and programs that directly manipulate hardware, like Symantec's Norton Disk Doctor, won't run.

We experienced minor display problems when starting a few Lotus Development applications, and Microsoft Word 6.0 for Windows initially refused to load. Tweaking the Win-OS/2 memory settings cured both problems. Hewlett-Packard's Dashboard 2.0, which stops cold under Windows NT, behaved perfectly under OS/2 for Windows. And we had no problems using OLE 2.0 to insert a Microsoft Word object into a Microsoft PowerPoint presentation.

The Bottom Line

OS/2, a *PC/Computing* MVP Award winner for two straight years, keeps improving with age. If you were tempted by OS/2 2.1 but turned off by the clumsy way it handled the Win-OS/2 subsystem, it's time to take another look. It's still the most powerful and compatible 32-bit operating system you can put on your desktop.

ED BOTT

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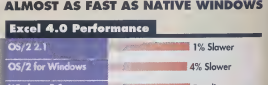
FAST VIDEO

IBM's OS/2 for Windows includes a 256-color driver for S3-based video boards like the Diamond Stealth boards, but the installation process far the new drivers was needlessly complex. The advantage: You can run OS/2 and Windows applications seamlessly at up to 1,280-by-1,024-pixel resolution. The performance payoff at higher resolutions is worth it, too: A Microsoft Excel macro that crawled under the plain VGA drivers was able to keep pace with Windows 3.1 using the S3 Super VGA setup.

General caveats: This version of OS/2 works only with Windows 3.1, and you'll need the Windows disks to finish the installation. If you're running Windows for Workgroups, you're out of luck—at least for now. There's no built-in support for DoubleSpace disk compression either, but Stac Electronics offers an OS/2 edition of Stacker that also runs under DOS and Windows.

PC/COMPUTING LAB REPORT:
ALMOST AS FAST AS NATIVE WINDOWS



Note: Time to run a complex Excel 4.0 macro. Tests run of 800-by-600-pixel resolution with S3 Super VGA drivers.

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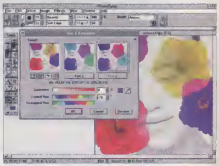

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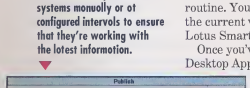
Borland Office 2.0: Does Best of Breed Equal Best of Suite?

EASY SHARING

A suite isn't worth its weight in floppies if it doesn't give you an easy avenue for sharing data, and Borland Office 2.0 is a winner in this area. All three applications in the suite support DDE, OLE 1.0, and most notably, Borland's Workgroup Desktop, which is driven by the Object Exchange (OBEX) technology.

Through the Workgroup Desktop, users can publish and subscribe via Novell MHS, Lotus Notes, WordPerfect Office, MAPI and VIM e-mail services, in addition to other LANs and MCI Mail. Users have control over the number of document versions they can make available to subscribers. Subscribers can poll their systems manually or at configured intervals to ensure that they're working with the latest information.



BREEDING IS A tricky business. Mix two champion golden retrievers and you'll end up with a litter of beautiful pups. But take one of those golden retrievers and mate it with a pedigreed hairless Chihuahua, and who knows what you'll end up with. It's the same with software.

In Borland Office 2.0, you'll find three best-of-breed applications, all *PC/Computing* 1993 MVP Award winners: Borland Quattro Pro 5.0 for Windows, Workgroup Edition; Borland Paradox 4.5 for Windows, Workgroup Edition; and WordPerfect 6.0 for Windows. This suite of applications shares much more than a layer of shrink-wrap, although their consistency and integration is not as strong as what you can get from Microsoft or Lotus.

Installing the Borland-WordPerfect suite is easy, thanks to a common installation routine. You won't find anything like this in the current versions of Microsoft Office or Lotus SmartSuite.

Once you've installed Borland Office, the Desktop Application Director (DAD), helps you navigate among applications. Similar to Microsoft's Office Manager (MOM)—don't blame us, we didn't name these products—DAD lets you launch each application and gives you access to a file-management facility and application options. DAD also includes a few icons to make data sharing a snap between Quattro Pro and WordPerfect. You can configure DAD to launch other applications on your system, as well. DAD is comparable in power and capability to MOM, and is way ahead of SmartSuite, which lacks an independent control center.

By default, each application in Borland Office 2.0 retains its own distinctive look, feel, and collection of capabilities. Only four icons are shared by all three applications.

Application Integration

In our usability testing of software suites (see "Suite Sensations," February, page 158), we found that strong similarity among suite products means enhanced ease of use in all of the suite applications. Unfortunately, Borland Office is a victim of bad breeding in this area. There is a distinctive look and feel to the Borland applications that is radically different from WordPerfect.

You'll find only four icons shared by all three applications: cut, copy, paste, and print. WordPerfect and Quattro Pro share six additional buttons to bring the common icon count up to ten, but Paradox is left out in the cold. You can load several WordPerfect button bars into Quattro Pro, such as the Layout or Power Bar button bars, but these really don't give you any added functionality over the defaults. Lotus's common SmartIcons are significantly better.

There's no arguing that there are three outstanding applications holding up Borland Office, and there's a lot of power in its data-sharing capabilities. But the application integration is still shy of the level we've seen in Microsoft Office or SmartSuite. If you're already using two or three of these applications, the added integration will suit you well. But compared to the Microsoft and Lotus suites, the Borland-WordPerfect product has a lot of growing to do.

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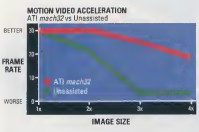

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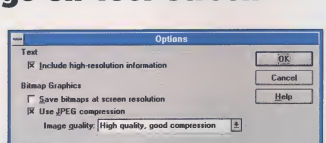

When you distribute your documents in Common Ground's portable format, it's worth checking out the Options dialog box for image quality, compression, and security options.

Anything you can see on the printed page, Common Ground puts into a digital format that can be viewed on almost any Macintosh or PC, regardless of the fonts installed or the operating system. (Common Ground is available on the Mac and PC.)

Like the Acrobat suite and Replica, Common Ground acts as a Windows print driver, intercepting any print job and translating it into a DP (Digital Paper) file. Like Replica, Common Ground's viewer can be distributed free of charge, which makes document distribution cheaper than Acrobat's $50-a-pop Reader. Common Ground handles TrueType and PostScript fonts equally well. It can also save DP documents in a variety of word processing formats, using Panose font matching to substitute the closest look-alike for missing fonts.

A Good Start

Common Ground has several outstanding features that are unfortunately hampered by incomplete implementation. For example, although security features in the first release allow you to prevent copying and printing of DP documents, there's no password protection. You can embed the viewing program into a DP document—pumping up the file size by about 90K and giving it an .EXE extension—but this process is not as easy as it is in Replica. And the excellent four-level Joint Photographic Experts Group (JPEG) compression is available only at print time, hidden under several unintuitive menu layers. Finally, the first release of the program lacks the hypertext links, bookmarks, and Post-It–style notes that make Acrobat handy.

The Best Buy

Acrobat takes the crown for publishing purposes because of its fidelity to PostScript, its hypertext linking, and its support for very high resolutions. But it's expensive—$50 per Reader, $195 for Acrobat Exchange, and a whopping $695 for the Distiller (a conversion utility that neither alternative provides or requires). Farallon's low-cost $99 Replica provides a free file viewer and has useful extras—password protection, type-quality selections, and self-executing documents that are easy to find and use. But the program's files are large and its PostScript handling is flawed.

For all-around type handling, color-file compression, and direct export capabilities, it's hard to fault Common Ground. The less-than-$100 introductory pricing (good through July 1) sweetens the deal. Even when the price goes up to $189.95, Common Ground will still be a bargain compared with Acrobat. For distributing the best-looking general-business documents, Common Ground is the pricewise choice. **MATTHEW LAKE**

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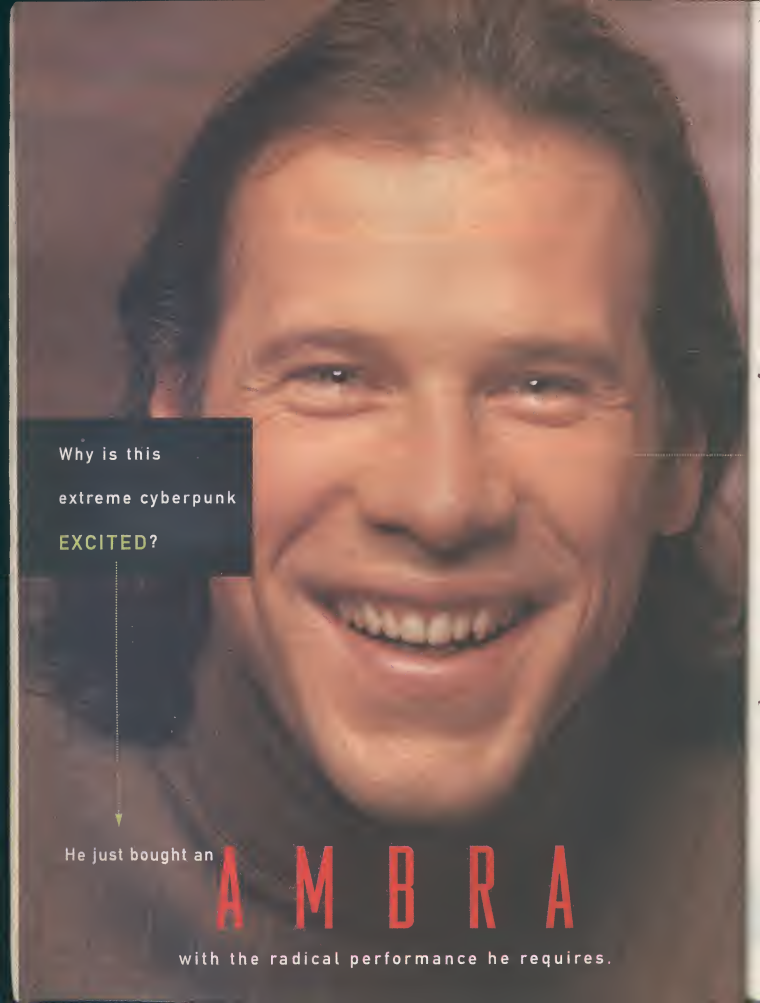
JUST YOUR TYPE

The kind of fonts you use has an impact on your document exchange options. If you work at a PostScript house and money is no object, Adobe Acrobat is your best bet. The program uses Adobe Type Manager 2.6 to handle PostScript fonts with masterful ease, but its TrueType handling is subpar (top screen).

Your type is True? Since you can embed large quantities of TrueType information in a Farallon Replica document, it can reproduce such fonts exactly (at the cost of disk space)—although its default settings can sometimes display awkward spacing (middle screen). In addition, Replica doesn't talk PostScript.

No Hands Software's Common Ground (bottom screen) treads a fine line between both camps. In our font-laden test documents, it produced precise duplicates of original documents faster than Acrobat or Replica—and its documents took less space than Replica's.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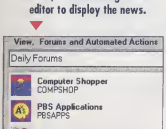
TRY BEFORE YOU BUY

CompuServe Navigator (CSNav) isn't the only money-saving Windows front end for CompuServe—the shareware program WinCIS does the same thing. In fact, WinCIS has something that CSNav doesn't have: a scripting language that automates a wide variety of tasks, such as dialing in to ZiffNet, downloading Newsbytes news, then launching a text editor to display the news.



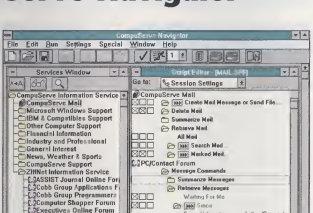
However, WinCIS doesn't use the HMI (Host Micro Interface) protocol, so it downloads messages and headers more slowly than CSNav.

At press time, WinCIS was still in a beta version—but it may be shipping by the time you read this. Even if it isn't, you can still give it a try. Download the program from the Windows User Group Network on CompuServe (GO WUGNET). You'll find it in library 12 (WinCIS).

COMPUSERVE IS A gold mine of file downloads and useful forums, but no one would accuse it of being inexpensive or easy to use. The most cost-effective way to take advantage of the service is to log in, pick up the information and files you need quickly, then log out. But the service's convoluted menus aren't suited to this sort of speed-shopping exercise.

CompuServe Navigator, Windows Version (CSNav) is CompuServe's most recent attempt to solve both the cost and ease-of-use problems. It's a Windows-based front end that dials into CompuServe and handles uploads and downloads automatically. It allows you to do all of your reading and preparation offline while the meter's not ticking. CSNav will undoubtedly cut your online costs, most likely by a significant amount.

It works like this: You tell it which forums you want to check for messages. It dials in to those forums and downloads the message headers to your PC. You then read the headers or messages at your leisure, when you're not being charged for connect time. Mark the headers of the full messages you want to read, and CSNav dials back in to the service and downloads the full messages, which you then read and respond to offline. If you've written responses to any messages, the program dials in one more time and sends them. You save enormous amounts of online time. Using only a few minutes of connect time a day, you can check messages in many forums. The program will also dial in to forum libraries and download file descriptions so that you can search for files offline, and download the interesting ones later.



CampuServe Navigator saves you time and money by automating your online CompuServe sessions. It's not easy to set up, but if you regularly receive steep online bills, you need this program.

Could Be Easier to Use

The prerelease version of the program we reviewed was undermined by some design flaws. Setup is confusing. You have to create a script to do anything, and while this is a point-and-click operation, it's tougher than it need be. You have to burrow several levels down, for example, just to set up a multiple-pass session of the type described above.

On the positive side, the program uses CompuServe's Host Micro Interface (HMI), so that messages and headers can be downloaded extremely quickly (saving even more money). And once you've fumbled your way through setting up a script, the program is easy to use. CSNav also shares common resources with CompuServe's other Windows guide, CompuServe Information Manager for Windows (WinCIM). If you use both programs—and you could, since WinCIM is designed for online dabbling, unlike CSNav's cost-effective online/offline model—the programs can share a single address book.

In short, CSNav isn't perfect, but it's a vast improvement over working in terminal mode on CompuServe, and it's much more economical than its online sibling, WinCIM. For Windows buffs, CSNav is preferable to DOS front ends TAPCIS and OzCIS. To find out about ordering the software online, type GO CSNAV on CompuServe. **PRESTON GRALLA**

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AutoCAD LT: Slimmed-Down But Powerful Modeling

YOU CAN TELL that Autodesk's AutoCAD is the heavyweight champion of CAD software because it knocks most users right out of the ring. With AutoCAD's $3,750 suggested retail price, its scope, and a learning curve that has spawned an economy of AutoCAD training tools, it's simply not a program for the occasional user. But there's a new version in the ring: the $495 AutoCAD LT, a slimmed down, but not flyweight, take on the classic AutoCAD Release 12 for Windows.

If you have a smattering of CAD experience, AutoCAD LT is a snap to use. It has the familiar look of AutoCAD Release 12 for Windows. But there's less clutter to deal with (and to learn), because LT leaves out capabilities for simultaneous multiple sessions, for comprehensive 3-D design and modeling support, and for the third-party add-ins that the George Foreman version of AutoCAD supports. The absence of exotic features makes the interface a bit more streamlined and easier to learn—a situation reflected in the relative paucity of its documentation. One thing LT has that AutoCAD doesn't is an online tutorial. LT also has about half the system requirements of AutoCAD.

Drawing with Dimension

AutoCAD LT is a formidable tool for most 2-D design tasks. LT retains the bulk of AutoCAD's 2-D tools and features, so you can create, edit, and modify drawings with precision equal to the full version of AutoCAD. You get the same useful drawing tools along with editing time-savers like multiple snap modes (to quickly position objects onscreen), and array builders (for creating regular, repeating objects in a variety of configurations).

What you don't get are the robust 3-D capabilities of AutoCAD. LT limits you to creating 2-D extrusions, although you can view and edit 3-D drawings in DWG format, and work with hidden-line removal and shading. You can't render images, however, nor can you access the extensions that enable AutoCAD to create and view 3-D models that look realistic.

LT is also missing support for the Windows multiple-document interface—while you can have several documents open at once in AutoCAD Release 12, LT allows you just one. And LT lacks the extensive customization and flexible setups that AutoCAD has. Finally, LT is missing the AutoLISP programming language.

Still a Powerhouse

AutoCAD LT is a good standalone tool. But we think it would also make a nice low-cost front-end to its older and stronger sibling. Since LT reads and writes AutoCAD DWG files, it is useful for reviewing and touching up designs created at more expensive AutoCAD seats. With its combination of power, ease of use, and AutoCAD compatibility, LT opens up serious CAD capabilities to users otherwise cowed by AutoCAD's massive financial and system requirements. **JON PEPPER**

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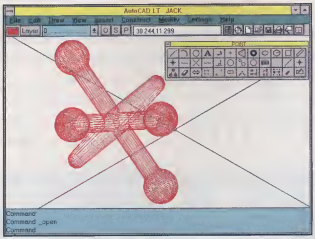


AutoCAD LT's main drawing screen will be very familiar territory to anyone who has worked with AutoCAD Release 12 for Windows.

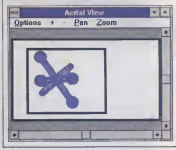
LT = LOTS OF TRAINING?

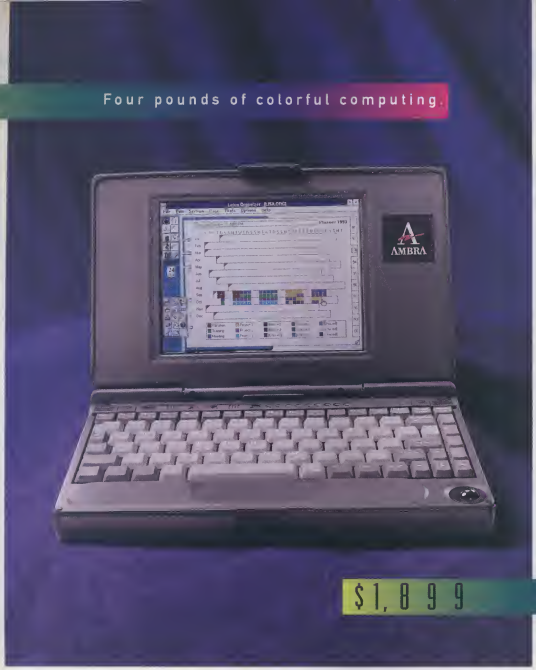
OK, using Autodesk's AutoCAD LT isn't as easy as sketching on a napkin. Nevertheless, we found LT easy to learn and use. With the addition of a guided tour, you have instant access to a comprehensive online tutorial that makes the manual almost obsolete. The tour covers most of LT's key features and shows you exactly how to use them.

Unlike many pared-down versions of well-known products, LT doesn't shortchange you when you need serious capabilities. Need complex drawings? LT supports an unlimited number of layers and entities to make it easier to group related components or to control characteristics of parts of a drawing.

AERIAL VIEW WINDOW

Use the Aerial View window to quickly and easily pan and zoom your view of the current drawing without entering measurements of selecting points.





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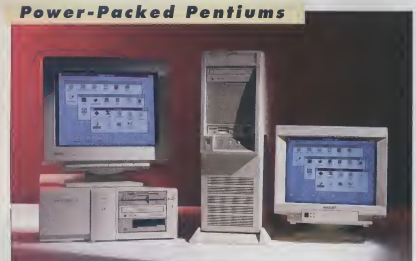

SPEED FOR EVERY NEED
Insight Direct's PCI P60 MM (right) is the best-performing Windows PC we've tested, while Dell's Dimension XPS P60 is a well-rounded system with high-quality graphics and multimedia extras.

Like so many early Pentium/PCI-based PCs, both use Intel's new motherboard, giving you three PCI slots and four ISA slots. But Insight's PCI P60 MM is the first system we've seen with Intel's new IDE controller in one of its PCI slots. That more than overcomes an advantage the XPS P60 has in video performance to make the PCI P60 MM our overall Windows speed champ to date. Look for other vendors to catch on and emphasize hard drive performance in the months ahead.

A LOT OF COMPUTER companies know who you are: the mindworker who has adopted the PC as a can't-live-without-it personal tool, much the way others have latched onto Day Runners or cellular phones. What they have trouble agreeing on, however, is what's important to you.

Dell and Insight Direct assume the obvious—that a cutting-edge user like you will want a Pentium processor in your next computer. To this base they add a host of cool multimedia add-ons. Compaq, on the other hand, has tuned and polished the 486 architecture (see opposite page).

Dell's Dimension XPS P60 is the big brother of Dell's 486DX2/66-based Dimension XPS 466V that has done so well in our Windows application benchmarks. The XPS P60 does better, of course, because of its 60MHz quasi-RISC processor backed by 256K of write-through secondary cache. The XPS P60 rips through graphics tests thanks to a Number Nine GXE-PCI card in one of the system's three 64-bit PCI local-bus slots. Its 1MB of fast VRAM displays 256 colors at 1,024-by-768-pixel resolution on Dell's crisp 15-inch VS monitor. You can expand video memory to 3MB for 65,000 colors at 1,152-by-870-pixel resolution.

As its name suggests, Insight's PCI P60 MM system matches Dell's XPS P60 in the processor department. But the PCI P60 MM uses an ATI mach32 video card in one of its three PCI slots and can hold only 2MB of VRAM. That means that the maximum you'll get on the PCI P60 MM's 15-inch, 0.28 dot pitch Mag InnoVision monitor is 65,000 colors at 1,024-by-768 resolution.

On the other hand, Insight takes advantage of the PCI P60 MM's tower case to give you virtually unlimited drive expandability. In addition to its 12ms, 540MB Quantum IDE hard drive, 1.44MB floppy drive, and 320ms Mitsumi dual-speed CD-ROM drive, the system still has three open external 5¼-inch external bays and five open internal 3½-inch bays. Dell's XPS P60 is intended to meet the average user's storage needs with a standard desktop case and one of each kind of bay available—after it's loaded with a 16ms, 450MB IDE drive, floppy drive, and Panasonic CD-ROM drive.

Multimedia Goodies

The XPS P60 has a broad selection of high-end multimedia components, including a Creative Labs Sound Blaster 16 audio card that controls a Panasonic dual-speed CD-ROM drive.

Insight's PCI P60 MM has a Mitsumi CD-ROM drive with 320ms access and 64K of cache controlled by a Reveal SC400 Sound Blaster 16-compatible sound card. We couldn't get this combination to transfer data above the 160KBps rate in our tests, resulting in slow CD-ROM data transfer and video that wasn't always synchronized with audio.

At $3,166 for a basic system with 8MB of RAM, Dell's XPS P60 is a good buy for the power user who wants the ultimate in video. The Insight PCI P60 MM has a price tag of $4,449, but it includes 8MB more memory, a bigger hard drive, and a clear advantage in speed and expandability.

MIKE HOGAN

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Or 486 Stability?

WHEN IT COMES to PCs, one size does not fit all. Sure, Compaq's ProLinea MT 4/66 Model 340/CDS runs slower than Pentium PCs. But its disk and video subsystems actually scored higher on our tests. The ProLinea MT is a stable performer in the safe part of the technology curve that combines a low price (for Compaq) with one of the best warranty plans around.

Unusual Expandability

With five ISA slots and five drive bays (four external), the tower ProLinea MT is the most expandable personal Compaq system to date. One of the ProLinea's internal bays is filled by a fast 12ms, 340MB IDE hard drive with a bountiful 256K of cache. A Panasonic CD-ROM drive and 1.44MB floppy drive fill a pair of the externally accessible bays.

The standard ProLinea MT comes with 4MB of memory expandable to 64MB, and it costs $215 for another 4MB (which we highly recommend) and $429 for another 8MB of memory. We tested the ProLinea MT with the optional 128K of processor cache (which costs $99).

There are no open local-bus slots in the ProLinea MT. Graphics move through Compaq's own home-grown local bus, driven by a Cirrus Logic graphics engine. With 1MB of video dynamic RAM (expandable to 2MB), you'll get 256 colors at 1,024-by-768 resolution on Compaq's 151FS Color Monitor. The ProLinea MT's video actually outperformed the cutting edge Pentium systems in our subsystem tests. Credit Compaq engineering.

Similarly, the ProLinea MT passed our multimedia tests with flying colors. A fast SCSI Sound Blaster 16 audio card drives the CD-ROM, yielding smooth and synchronized video. A pair of speakers and a Compaq microphone with a convenient holster on the monitor round out the multimedia package.

The estimated selling price for this configuration is $3,018 at Compaq dealers. This is not cheap for a 486, but Compaq gives you a 3-year warranty, the first year of which includes onsite repair with 24-hour phone support that's good seven days a week for the life of the system. (In contrast, Dell gives you only a year of onsite repair and the same phone support as Compaq offers for the life of the system. Insight provides a one-year, mail-in warranty on parts that you must install yourself, and a year of phone support, available during a varied schedule of extended business hours.)

The ProLinea MT is a little less system for a little less money, but its performance almost matches the Pentiums we tested, so its price is appropriate. The best thing about the Compaq? The best warranty in the business. **MIKE HOGAN**

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A 486 Speedster

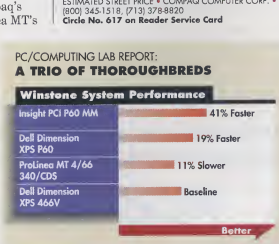
THEY ALL BURN RUBBER
There's more than enough CPU power in the Dell Dimension XPS P60 or Insight PCI P60 MM to meet any multimedia challenge. The Compaq ProLinea MT 4/66 340/CDS (above) is at the top of the 486 class—just a step behind the Dimension XPS 466V.

Significantly, the key differentiation in both system classes isn't CPUs or graphics, but hard disk subsystems.

The Dimension XPS 466V outpaces the ProLinea MT 4/66 340/CDS because of track-to-track buffering on its hard disk.

Insight's PCI P60 MM sped by the Dimension XPS P60 because of its PCI-based IDE controller. The PCI P60 MM disk transferred data 17 percent faster than the same hard drive in the Dimension XPS P60.

PC/COMPUTING LAB REPORT:
A TRIO OF THOROUGHBREDS



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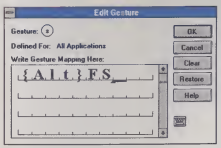
Move Over, Newton! Handwriter Puts Pen Power on Desktop PCs

MACRO USABILITY
Communication Intelligence's Handwriter for Windows includes a handful of pencentric utilities. There's a trainer application to teach Handwriter your handwriting style, an addictive crossword-puzzle game, and a maximum-security screen saver called Signature Sentinel, which recognizes your signature.

But the most practical add-in allows you to create macros that use up to 60 keystrokes. In this example, we've defined a circled S as Alt-F, S— the command to save a file in any Windows application. You can use any circled letter as a custom macro.



CALL IT THE Doonesbury effect. After Garry Trudeau's devastatingly accurate send-up of the Apple Newton Message Pad's slow and spotty handwriting recognition, pen-based products are now dismissed as useless technogadgetry.

That's a shame, because Communication Intelligence Corporation's (CIC's) new Handwriter for Windows, while not perfect, makes a powerful case for adding pen computing capabilities to your desktop PC. It integrates gracefully with Windows applications, and its handwriting recognition is the best we've ever seen. For anyone who's more comfortable with a pen than a keyboard, it's the only way to work.

For $399, you get a lightweight, rugged digitizing tablet with a cordless pen, plus Microsoft's Windows for Pen Computing and CIC's superb handwriting recognition add-in module. Installation of the Handwriter is simple: Plug in the serial cable and AC adapter and swap three disks to add pen capabilities to your existing copy of Windows 3.1. After rebooting, you're ready to roll.

An excellent tutorial, help, and a quick reference card help cut Handwriter's learning curve ta size.

The Pen Is Mightier

With Handwriter installed, the Windows cursor turns into a pen automatically. Some applications, such as Word 6.0 for Windows, are already pen-aware. To deal with those applications that aren't, Handwriter provides the PenPal applet. On our test systems, we experienced only minor problems: PowerPoint allowed us to use ink but didn't change the cursor to a pen. In Lotus Development's Freelance Graphics for Windows, the cursor behaved properly but displayed incorrectly.

The Handwriter's handwriting recognition is excellent. Most handwriting recognizers require you to be as precise as a draftsperson; this one tolerates a bit of sloppiness, even recognizing some connected letters. To make the best use of Handwriter, you'll need to learn ten basic gestures, such as cut, paste, backspace, and undo. A check mark, for example, pops the highlighted word into an editing window, while a quick back-and-forth swiping motion deletes the selected word.

A Mouse Replacement

The pen-and-tablet combo can replace your mouse or coexist with it. On the down side, exotic key-click combinations are tricky. Right-mouse-button clicks take some getting used to, and simultaneously clicking on both buttons is impossible.

The more serious failing of Handwriter, at least for now, is the woefully inadequate video support for Windows for Pen Computing. With the exception of the Hercules Graphite card, there are no drivers for popular high-resolution Windows video accelerators. With an incompatible video driver, you can't see the ink or the pen cursor. The only solution is to reinstall Windows 3.1 with the generic VGA or Super VGA driver and beg the video board maker for a pen-aware driver.

Using Handwriter is disorienting at first, but after a few days the pen feels more natural than a mouse. For pure productivity, it beats the Newton, hands-down. **ED BOTT**

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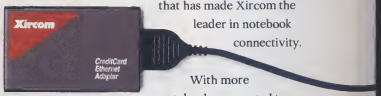

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Lexmark WinWriter 600: Quality Low-Cost Windows Printing

THE TRADEOFF

The Lexmark WinWriter 600 isn't exactly fast. Overall, it printed slower than the HP LaserJet 4. A 5-page Ward for Windows letter took 47 seconds to print on the LaserJet 4 and 52 seconds on the WinWriter 600. And the disparity in speed became more dramatic as the documents got increasingly more complicated. The WinWriter 600 took 13 seconds longer to print the business report and took more than twice as much time (127 seconds vs. 52 seconds) to print the graphics presentation.

The WinWriter 600 uses your computer to process pages, so the faster your system, the faster your documents will print. Our test system was a 486DX/33 with 4MB of RAM. And while a faster processor will enable the WinWriter 600 to print faster, even with a 486DX2/66 system it was still slower than the LaserJet 4.

LIKE IT OR not, it's a Windows world out there. Microsoft's GUI operating environment, in fact, keeps turning up in the most unusual places—like Lexmark's WinWriter 600 laser printer.

The WinWriter 600 is an 8-page-per minute, 600-dot-per-inch printer with a twist: It incorporates Microsoft's Windows Printing System (WPS). (See "The Windows Printing System Puts You in the Driver's Seat," New! February 1993, page 62.) The WPS moves document processing to the PC, so features such as a fast RISC processor, tons of fonts, and gobs of RAM aren't needed in the printer. The big advantage: lower cost.

Using Windows instead of PCL or PostScript, the WinWriter 600 offers 600-dpi printing for hundreds less than the LaserJet 4.

Windows in a Printer

The WinWriter 600 uses WPS to tightly integrate with Windows, although it also offers PCL 4 emulation for printing from within DOS applications. Feature for feature, the WinWriter 600's closest competitor is the Hewlett-Packard LaserJet 4, but the WinWriter 600 has a retail price of $1,399, which is $450 less than the LaserJet.

What do you sacrifice for the lower price? One thing is networkability. The WinWriter 600 can be a shared resource under a Windows for Workgroups peer-to-peer network, but otherwise it can be connected to only one PC. Another drawback is print speed. The WinWriter 600 requires at least a 386 system with 4MB of RAM, but in our tests on a 33MHz 486DX system with 4MB of RAM, the LaserJet 4 outperformed the WinWriter 600 in all 600-dpi tests. A faster processor will improve the WinWriter's performance, although even when we tested the two printers on a 486DX2/66 system with 16MB of RAM, the LaserJet 4 was still faster.

Excellent Text

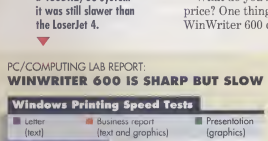
Most PC users print text, the whole text, and nothing but the text all day long, and the WinWriter 600's text quality was better in some ways than the LaserJet 4's. Though it wasn't quite as crisp as the LaserJet's, it was darker and easier to read. The WinWriter 600's graphics quality was top-notch as well.

Even at a street price of about $1,199, the WinWriter 600 is pretty pricey for a personal printer. But upgrading this printer is easy. Want faster printing? Upgrade to a faster PC and see the benefits when you print, but also as you work in your applications all day long. Want more fonts? Simply pick up the latest TrueType font pack and you can print them, with Wysiwyg results, on your WinWriter 600. The LaserJet 4 may be more versatile with its networkability and fast graphics printing, but the Lexmark's expandability, lower cost, and great text printing make it a personal printer that can't be beat.

CYNDY BATES

PC/COMPUTING LAB REPORT:

WINWRITER 600 IS SHARP BUT SLOW



Note. Tests ran in 600-dpi mode on a 486DX/33 with 4MB of RAM.

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Alphatronix's Inspire III—Optical Storage for Cents per Megabyte

SPEED READER
You wouldn't want to replace your hard drive with an Alphatronix Inspire III G Series. True, compared with tape backup and other archiving solutions, it's a screamer. But it's not designed for constant reading, writing, and deleting of files.

During our tests, we checked how fast the drive wrote and read data—first sequentially, then randomly. Random writing and reading is how drives handle fragmented storage media—drives become naturally fragmented after a few weeks of normal daily use. Compared with an IDE drive, the Alphatronix drive had trouble writing to the media—a lot of trouble when the media became fragmented. But it flew through reading. In fact, it handled random reads faster than the traditional drive. The upshot? If you use the drive for archiving and quick retrieval, you'll be more than happy with its performance.

REMEMBER WHEN YOU moved into your first house with walk-in closets? It seemed you could store all your clothes and still have room left over for a desk and a lifetime supply of junk. Well, the desk never made it in, the crockery is spilling out into the hallway, and those closets seem awfully tiny.

It's the same with disk space—except you can't run to a hardware store for a closet organizer. When the disk is full, you have three choices: delete, archive, or spend. Before you run out and blow a month's pay on a dead-end solution, look at the Alphatronix Inspire III G Series optical drive.

With a capacity of a whopping 1.2GB per cartridge and 18ms average access time, the Inspire III is a no-sacrifices storage solution. It's fast enough for online data access, and it's great for storing or transferring large graphics, sound, or video files between sites. And if you need to archive data from a network but have to be able to access it fast, it's a godsend.

Room to grow and speed to burn: Alphatronix's Inspire III G Series drive solves the storage blues.

Optical's Clear Advantages

The beauty of optical drives is that you don't run out of space: You just pick up a new cartridge. And the Alphatronix drive uses cartridges from any manufacturer that supports International Standards Organization, International Electrotechnical Commission (IEC), and European Computer Manufacturers Association (ECMA) standards. Worried about bit decay? The company is betting on its Alphaguard error correction: Alphatronix guarantees data integrity on optical storage for 30 years. Every time a sector is read, Alphaguard calculates what it would take to perfectly reproduce that sector in the event of data loss. If the data reaches a critical point, it is rewritten to a spare sector for safety's sake.

PC/COMPUTING LAB REPORT:
INSPIRE III IS AS FAST AS A HARD DISK

Speed at a Price

Not that you'll notice error correction slowing down the drive: This new drive spins at 4,800 rpm, has a seek time of 18ms, and boasts a 4MB cache. In our disk tests and other drive performance benchmarks, the Inspire III showed sustained transfer rates of more than 2MB per second, with bursts near 5MBps.

The price tag, however, isn't for the faint of heart. At $4,895, it's far beyond a starter hard disk. But the drive cost is an investment that amortizes well when your storage needs cross the 2GB mark. From then on, your cost per megabyte flattens out dramatically. Typically, you can get a 1.2GB cartridge for $200—that's 16 cents a megabyte, as opposed to a dollar a megabyte for hard disk storage.

The Alphatronix Inspire III won't replace your high-capacity hard drive—optical technology simply can't write data fast enough. But it's a great choice for offsite storage or transferring data between sites one gigabyte at a time. If you need gigabytes of data to go, and you don't want to continually upgrade your drives, try the Inspire III.

ADAM MEYERSON

INSPIRE III G SERIES • $4,895 • ALPHATRONIX CORP. • (800) 849-2611, (919) 544-0001
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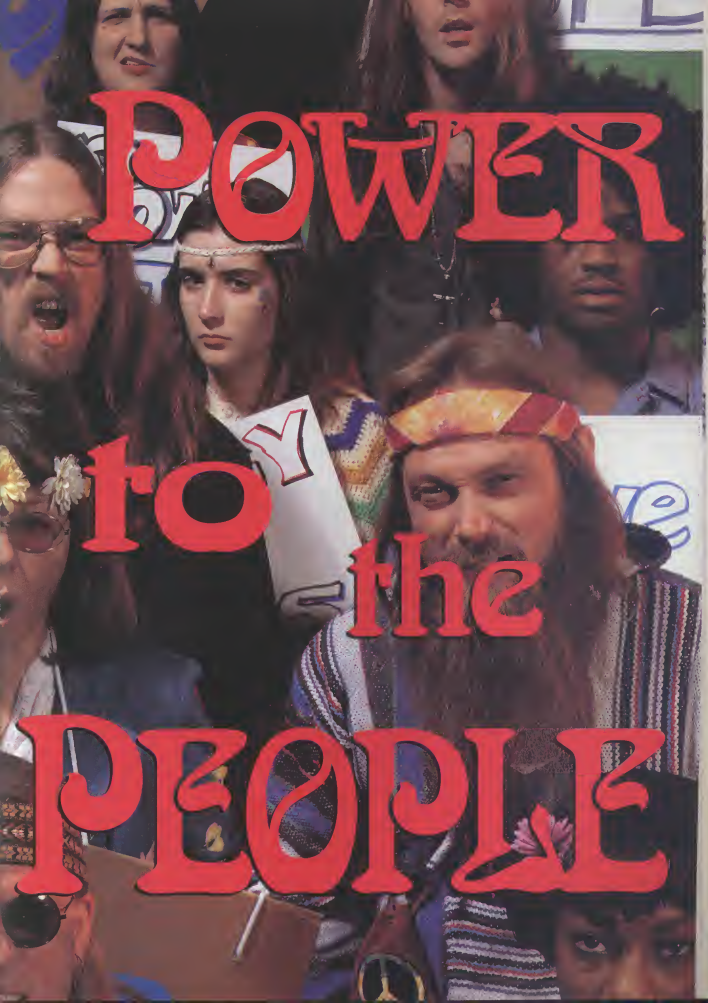
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Now more than ever, we're giving power to the people. Our Pentium-based PCI systems are priced hundreds, sometimes thousands of dollars less than competitors' comparably configured Pentium systems. That's PC power everyone can afford!

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Best Overall Systems Supplier

#1 in Overall Reliability & Likelihood of Buying Again, 1993 & 1994

Best Service Best Mail Order Co.

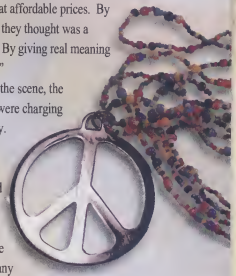
Best Service

You Got It, Baby!

By the Time We Get to Woodstock

When historians write the history of the personal computer industry years from now, they'll remember Gateway 2000™ as the radical PC manufacturer that gave power to the people by selling the highest-quality, latest-technology computers at affordable prices. By showing PC buyers a level of service they thought was a throwback to the peace and love era. By giving real meaning to the tattered, worn-out term "value."

When Gateway 2000 came onto the scene, the establishment computer companies were charging whatever they wanted for technology. Gateway was a real downer to them because we began selling the same technology for a whole lot less. And the buyers were very smart. They shouted, "Hell no, we won't go," to the big companies, and took a chance on the revolutionary Midwest company called Gateway 2000. Soon a great legion of people — even more than Woodstock attracted — was buying Gateway PCs.



Today, Gateway 2000 is bigger than many of the companies for which it was an alternative. So why should you buy a Gateway computer today? Same reasons as in the beginning. You still get the best price, quality and service from us.

Demonstrations

That's why *PC Magazine* readers said Gateway 2000 was #1 in overall reliability, and we also received the most votes when readers were asked if they would buy again from the same company — in both desktop and portable PC categories. (Thanks, *PC Mag* readers!) That's why, for the third consecutive year, we swept *Computer Shopper's* Best Buy Awards. (Thanks, *Shopper* readers!) And that's why we took five top honors in *PC World's* World Class Awards, including Best Mail Order Company and Best Service and Support. (Thanks, *PC World* readers!) Even though we're now a Fortune 500 company, we still champion anti-establishment thinking. Check it out. You'll find GW2K is far-out, groovy and totally unreal!

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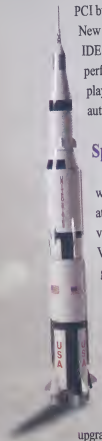
Gateway Gives You Performanc

The Eagle has Landed

When Gateway 2000™ introduced a Pentium™-based system — loaded — for under $4,000, everybody in the industry knew the Eagle had landed. The best PC value on the planet had arrived! The editors of *PC/Computing* heralded the accomplishment by naming it Best Desktop of 1993.

Then we topped our achievement by offering *four* Pentium processor-based systems, including a *new 66MHz model*, priced from $2,495 to $3,995. Now that's a giant leap in value for one of the highest-performance PCs on earth. These systems are tomorrow's technology available today at affordable prices — only from Gateway.

Our P5 systems include Intel's 64-bit Pentium processor, which moves instructions and data twice as fast as a 486 system. The P5 PCs get another performance boost from a PCI local bus. The PCI bus can operate 10% to 15% faster than a VESA® local bus. New this month, all PCI local bus systems also include a PCI IDE interface, which dramatically improves hard drive performance (up to twice as fast). The PCI bus' "plug and play" feature makes your PC easier to use, too, by automatically configuring peripherals.



Space-Age Video

The PCI bus is coupled with a space-age video system, with 2MB standard video memory giving you 64,000 colors at 1024 x 768 resolutions. The high-performance PCI-based video system achieves 16 million colors, true 24-bit, in VGA and SVGA resolutions. Our standard video system gives you the best overall performance on the market.

The net effect of the PCI local bus and this video system is computer performance that will send you into orbit. It's definitely far-out!

486 PCI Local Bus System is A-OK

The PCI local bus with PCI video and disk subsystems is also available in a 66MHz 486DX2 system, which is upgradable to the Pentium OverDrive™ processor. Another A-OK value in a high-performance system from Gateway!

Photo courtesy of NASA. Thanks!

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That's Out Of This World!

Our P5-60 was named Best Desktop of 1993 by the editors of PC/Computing. "(It) is nearly twice as fast as its nearest competitor at Windows operations. When it comes to top-of-the-line desktop systems, you can't beat high performance for a low price," states the editorial.

Our new 66MHz Pentium-based system is priced at only $3,995.

Best Desktop of 1993

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Be A Trend-Setter With A

Our 4DX2-66V model has to be one of the most highly decorated PCs in the history of the industry. For good reason! Like other Gateway VESA and integrated systems, it's a very attractive value.

4DX2-66V
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4DX2-66V
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4DX2-66V

4DX2-66V

4DX2-66V

4DX2-66V

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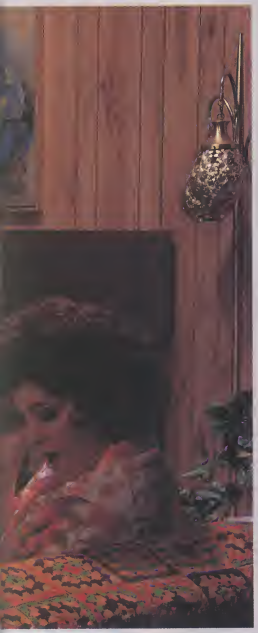

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Our VESA local bus machines give you go-go performance at a fab price. VESA, which stands for Video Electronics Standards Association, assures you of compatibility with any VESA peripheral. These systems are also upgradable to a Pentium™ OverDrive™ processor if you need more processor power in the future.

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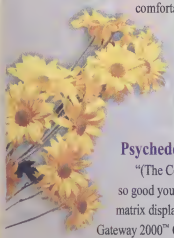
The HandBook has all the features that matter to you, too, including: ideal weight and size (less than 3 pounds, about the size of a day-planner); plenty of power (genuine Intel® SL Enhanced 486 processor); great screen (bright, 7.9-inch backlit VGA display); comfortable 78-key keyboard; EZ Point™ integrated pointer (no need to carry a clumsy mouse); excellent battery life; suspend/resume (a handy feature that allows you to stop work any time and resume later without losing data or restarting the system).



Psychedelic Day-Tripper

"(The ColorBook's) 9.4-inch dual-scan color display is so good you might think you accidentally got an active matrix display." That's what *PC Magazine* said about the Gateway 2000™ ColorBook. It's psychedelic! The ColorBook, with its latest-technology color display, also includes: 486 performance (genuine Intel SL Enhanced 486 processor); excellent portability (weighs less than 5.7 pounds and is ultra-thin — just 1.77 inches); simultaneous video support; a built-in trackball; two PCMCIA Type II slots (can also be used for one Type III PCMCIA card); great battery life (up to four hours); suspend/resume.

For dazzling color at a mono price, look no further than the ColorBook.

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HandBook
Best Subnotebook

HandBook
Best Subnotebook

HandBook
Best Hand-Held/Palmtop

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Add A Twist

Shown here is our P5-60 model loaded with options including a 17-inch CrystalScan monitor, combo floppy drive, multimedia kit with optional Yamaha speakers, Colorado Memory Systems tape backup unit, FlightStick and Epson Stylus 800 printer. With multimedia, the sights and sounds of any era are available to you with a click of your mouse. Right on!

intel inside

HANDBOOK® 486

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- SL Enhanced Intel® 486 Processor
- 4MB RAM (expands to 8MB or 20MB)
- 80 to 130MB IDE Hard Drive
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- 1 PCMCIA Type II Slot
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- Removable 120 to 250MB IDE Drive
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- NiMH Battery & AC Pack
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- 2 PCMCIA Type II Slots
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COLORBOOK 486DX-33

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COLORBOOK PACKS

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- 2 Labtec® Speakers
- Microsoft Encarta & Corel Photo CD Software
- Gateway System CD

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For system configurations that include a CD-ROM drive: **$132**

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SOFTWARE & EXTRAS

If a system comes with "choice of application software," choose one of the following packages:

- Microsoft Excel for Windows™
- Microsoft Word for Windows™
- Microsoft Word and Bookshelf® CD-ROM Edition
- Microsoft PowerPoint for Windows™
- Microsoft Project for Windows™
- The Entrepreneur Pack (Works,™ Publisher,™ Money™ & games)
- Borland Paradox® database and Quattro® Pro for Windows spreadsheet
- Microsoft Access™ for Windows
- Publisher's Pack (CD-ROM only; includes CorelDRAW3,™ ArtShow, MS Publisher 2.0 & MS Design Pack)

With desktop and selected portables you also get the following software and extras at no additional charge:

- MS-DOS 6.2 & Windows for Workgroups 3.11
- CoSession™ Host Remote Diagnostics (with all modems)
- QAPlus Diagnostics
- Gateway Computer Glossary
- Gateway Mouse Pad

Systems with CDs also include:

- Gateway System CD with Microsoft Multimedia Pack™
- Multimedia On-Line User's Guide
- Gateway Mall On-Line Catalog

SERVICE

Every Gateway system is backed by:

- 30-Day Money-Back Guarantee
- One-Year Limited Warranty
- Lifetime Toll-Free Technical Support
- On-Site Service Available To Most Locations
- Lifetime BBS Membership
- FaxBack Automated Fax Service

Our money-back guarantee does not include shipping. On-site service is provided at no charge during warranty if our technicians determine it is necessary. If you'd like to read our warranty and guarantee policies, please call for a free copy.

intel inside

Networking

Intel EtherExpress™

A 16-bit Ethernet adapter from a world leader in networking. **$105** Twisted Pair or BNC Kit (BNC kit includes cable, connector, terminator and card).

Ethernet Adapter from 3Com®

Manufactured by 3Com for Gateway. Features parallel tasking architecture with a high level of integration. **$105** Twisted Pair. **$125** BNC Kit (includes cable, connector, terminator and card).

Monitors

CrystalScan® 17-Inch Monitor

Non-interlaced color monitor, .26mm dot pitch. If your system comes with a 14-inch monitor, you can upgrade to this monitor for **$430**. If your system comes with a 15-inch monitor, you can upgrade for **$350**. (Prices good only for upgrades at the time of system purchase.)

Printers

Epson® 1070+ Printer

Here's a value-priced, wide-carriage dot matrix printer that gives you 225cpi in draft mode, 10 letter-quality fonts and 4 scalable fonts. Quiet, too (46.5db)! **$359**

Epson 3260 Color-Capable Printer

Add color to your documents with this 24-pin, quiet dot matrix printer. Comes with 10 letter-quality fonts. **$199**; Color Option **$45;** Tractor Option **$15**

Epson Stylus 800 Ink Jet Printer

Great laser quality at an even greater value. Measuring only 17 inches by 10.5 inches, the Stylus 800 has seven different typefaces and prints an extra-quiet 150 characters per second at 360dpi. Parallel cable included. **$289**

Epson ActionLaser 1500 Laser Printer

The ActionLaser delivers professional-quality printouts with crisp, sharp images, black blacks and smooth, "jag-free" lines. It also features a fast six-page per minute print speed, 14 resident fonts, 300 x 300dpi, and 1MB memory expandable to 5MB. Parallel cable included. **$669**

TI microLaser™ Pro 600

This Texas Instruments laser printer redefines value in high-performance printing with 6MB RAM standard, a fast eight pages-per-minute print rate, 500-sheet capacity and true 600dpi quality.

With 23 PostScript® Fonts: **$1,449**

With 65 PostScript Fonts: **$1,629**

Lexmark 4039 10R

The printer for tomorrow's technology! Featuring a fast, RISC processor it switches between PostScript and PCL5 printer languages automatically and prints at a remarkable 10 pages per minute at true 600dpi. **$1,399**

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We make it easy for you to buy a Gateway PC, too! We accept most major credits cards and C.O.D. terms, with net 30-day terms and leasing options available to qualified commercial customers.

You can also apply for our new Gateway 2000™ DuoLine™ MasterCard® Card, issued by Dial National Bank, which lets you make purchases from Gateway and anywhere else MasterCard is accepted by giving you two lines of credit — one for Gateway purchases and one for all other purchases. For Gateway purchases, the card has no annual fee and a low variable interest rate of just 12.9% APR. For other transactions, you get a variable interest rate of 13.9% APR and a low $18 annual fee.*

**Cash advance fee is $1 plus 2% of the amount of the cash advance, but not less than $5 nor more than $10. Financing is available on approved credit with the Gateway DuoLine MasterCard, issued by Dial National Bank, Des Moines, Iowa.*

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To Your Gateway PC!

When you've picked the PC you want, take a look at the options listed here to make your system as productive and fun as possible. Sorry, the peripherals listed here are sold only with the purchase of a system. For details on our complete line of extras for Gateway customers, ask for our special add-on components division when you call.

Multimedia

Multimedia Kit

Here's everything you need to add multimedia to your Gateway PC:

- Gateway 2000™ 16-bit CD-quality sound card, compatible with Sound Blaster™ cards, with MIDI/game port, mic in, stereo line in/out
- Double-speed CD-ROM drive, tray-loading, compatible with music CDs, multisession photo CDs and CD-ROM titles
- 2 Labtec® speakers that attach to your PC monitor
- Microsoft® Encarta & Corel Photo CD software
- Gateway 2000 System CD with Microsoft Multimedia Pack™

$299

For system configurations that include a CD-ROM drive, get the multimedia kit without CD-ROM drive for: **$132**

Yamaha®YST-M10 Multimedia Speakers

New! The small speakers that sound big. And come with a tiny price. This free-standing, self-powered speaker set is a great value! **$75**

Altec Lansing Multimedia Speakers

Get superior stereo sound with these top-rated Altec Lansing ACS-300 speakers with separate powered subwoofer. **$219**

CH FlightStick

The joystick that's recommended by our kids! With a sensational "feel" and rugged construction, this is the last joystick you'll ever have to buy! **$35**

Communications & Storage

TelePath™ II Fax/Modem

Internal fax/modem, 14,400bps modem, V.32bis, with 14,400bps fax capability. Package includes CommWorks™ data and fax communication software, plus a CompuServe® trial membership. **$149**

Cardinal® 2400 Fax/Modem

Internal fax/modem, 2,400bps modem, V.22bis, with 9,600bps fax capability. Package includes CommWorks data and fax communication software. **$49**

Colorado Memory Systems® TBU

250MB internal automatic tape backup unit copies up to 9.5MB per minute. Comes with Windows and DOS software, one tape and cable. **$159**

INTEGRATED & VESA SYSTEMS

4SX-33/4DX-33

- Intel® 33MHz 486SX or DX CPU
- 4MB RAM
- 212MB 13ms IDE Hard Drive
- Local Bus Graphics with 512KB
- 3.5" Diskette Drive
- 14" Color CrystalScan® 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard & MS Mouse
- MS-DOS® 6.2 & WFW™ 3.11
- MS Works for Windows™
- EPA Energy Star Compliant

4SX-33 - $1295
4DX-33 - $1495

4DX2-50/4DX2-66

- Intel 50 or 66MHz 486DX2 CPU
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- 212MB 13ms IDE Hard Drive
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- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- AnyKey® Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

4DX2-50 - $1795
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4SX-33V

- Intel 33MHz 486SX CPU
- 4MB RAM
- 212MB 13ms IDE Hard Drive
- VLB™ Graphics with 1MB
- Local Bus IDE Interface
- 5.25" & 3.5" Combo Drive
- 14" Color CrystalScan® 1024NI
- Baby AT Case
- 5 ISA & 2 VESA®/ISA Slots
- AnyKey® Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

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4DX2-50 FAMILY PC™

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- 8MB RAM, 128KB Cache
- 212MB 13ms IDE Hard Drive
- Local Bus Graphics with 1MB
- Double-Speed CD-ROM, 16-Bit Sound Card & Speakers
- 2400/9600 Data/Fax Modem
- 3.5" Diskette Drive
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard, MS Mouse & Joystick
- Choice of Family PC Software
- EPA Energy Star Compliant

$1995

VESA & PCI SYSTEMS

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- 424MB 13ms IDE Hard Drive
- VLB Graphics with 1MB
- Local Bus IDE Interface
- 5.25" & 3.5" Combo Drive
- 14" Color CrystalScan 1024NI
- Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

4DX-33V - $1975
4DX2-50V - $1995

4DX2-66V BEST BUY

- Intel 66MHz 486DX2 CPU
- 8MB RAM, 128KB Cache
- 424MB 13ms IDE Hard Drive
- VLB Graphics with 1MB
- Double-Speed CD-ROM
- Local Bus IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

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P4D-66

- Intel 66MHz 486DX2 CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

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4DX2-66V

- Intel 66MHz 486DX2 CPU
- 16MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- VLB Graphics with 2MB
- Double-Speed CD-ROM
- Local Bus IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
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P5-60

- Intel 60MHz Pentium™ CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 14" Color CrystalScan 1024NI
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- MS Works for Windows

$2495

P5-60 BEST BUY

- Intel 60MHz Pentium CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

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P5-60

- Intel 60MHz Pentium CPU
- 16MB RAM, 256KB Cache
- 540MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

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P5-66

- Intel 66MHz Pentium CPU
- 16MB RAM, 256KB Cache
- 540MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 16-Bit Sound Card & Speakers
- 3.5" Diskette Drive
- 17" Color CrystalScan 1776LE
- Tower Case, 300W Power Supply
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
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All prices and configurations are subject to change without notice or obligation. Prices do not include shipping. Energy Star compliant systems may not remain within EPA guidelines if upgraded to a Pentium processor.

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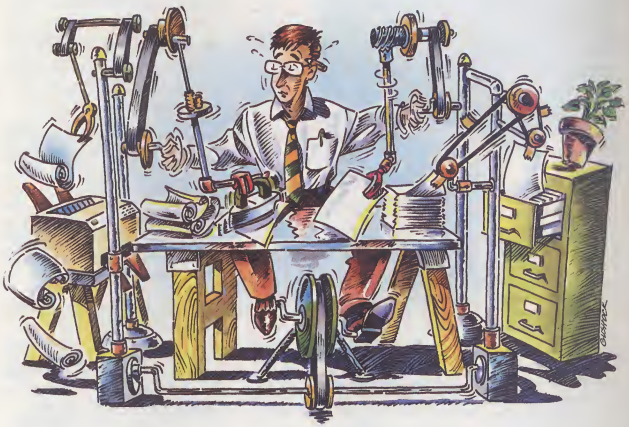

Sure, as long as you don't mind pedaling all day. But for those who want to solve their fax, paper document, and electronic file management problems in real time without breaking a sweat, there's Fax and Find,™ from Caere.

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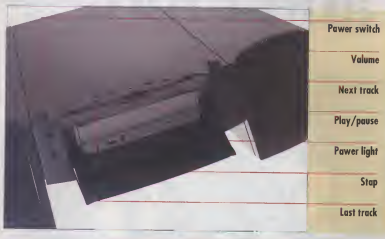
Circle 240 on reader service card.

Memphis Serves Up CDs, Sound, and Ease of Use



FINGERTIP CONTROL
Like NEC's line of triple-speed drives (reviewed in February New! page 59), Memphis is designed to play audio CDs as easily—or more easily—than CD-ROMs. You don't need the PC turned on to blast tunes from Memphis's big speakers, which can be detached and moved 6 feet in either direction for better stereo sound separation. The audio controls are easy to reach and use (see photo above). True, the unit we reviewed used a clumsy caddy to house the CDs, but by press time the drive will be replaced by one with a pop-out drawer similar to a modern audio CD player.

YOUR STANDARD MULTIMEDIA upgrade kit has a lot in common with a plate of spaghetti. Once you get past the sound card, CD drive, and included software, you're faced with a tangle of cords that would look more at home under a little marinara. But Media Vision's Memphis is a different dish altogether.

Like any upgrade kit worth buying, Memphis has a double-speed CD-ROM drive, a microphone, speakers, and a 16-bit sound card. It also includes a small collection of CD-ROM titles—including the obligatory Broderbund *Arthur's Teacher Trouble* (a 1993 *PC/Computing* MVP Award finalist) and Compton's *Interactive Encyclopedia.*

Hunka Hunka Burnin' Sound

The difference between Memphis and most upgrade kits is that the drive is external, integrated into a distinctive unit with two high-quality speakers. The sound card—a newly engineered Pro Audio 16 FM-synthesis board compatible with Sound Blaster and MIDI—has only two output ports, one for a joystick and another that hooks up to the main Memphis unit.

The tangle-free Memphis configuration is extremely easy to install and use, thanks to clear instructions and the single cable that runs between PC and Memphis's boom box. The Toon Town–like speakers sound great, too. The Memphis also gives you an upgrade bonus: To accommodate other SCSI devices, you can attach an external bracket adapter to a socket on the internal Pro Audio board.

The Memphis Blues

Despite the handy design, there are two main drawbacks to Memphis. First, it's too expensive: $999. While the speakers and convenience factors are much more appetizing than those of other multimedia upgrade kits, the sticker price is out of line. And in the unit we tested, the drive was an NEC 55J—an old model that performed sluggishly in most of our lab tests. It's also a caddy-based system, which adds a clumsy extra step to the process of swapping CDs. Media Vision claims that by press time, Memphis will use a faster drive without caddies; if you're shopping for Memphis, make sure you buy one of these later models.

What's the big draw to Memphis? You'll want it if you like the styling and convenience of a piece of audio equipment that's easy to use, and offers decent sound from your audio CDs. But if you're on a budget, you like your CD drives fast and your music quiet, and you can manage tangles of wires like a rock-and-roll roadie, then you won't.

MATTHEW LAKE

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Whether you're getting into the groove or gaming with *Just Grandma and Me*, Media Vision's Memphis is a distinctive, if not speedy, way to get going.

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- Digital Data Storage (DDS) technology
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- Backs up 300 MB as fast as 30 minutes
- Includes software, data cartridge and more
- Optional Cheyenne ARCserve® for PowerDAT™

PowerTape Series 2400

- Quarter Inch Cartridge (QIC) compatible
- 2 Gigabyte native/4 GB compressed capacity
- Up to 18 MB/minute backup speed
- Includes software and more
- Optional Cheyenne ARCserve® for PowerTape™

At the workgroup network

PowerTape Series 1100

- QIC compatible
- 525 MB native/1.05 GB compressed capacity
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- Includes software and more

Jumbo 500 AVAILABLE EARLY 1994

- QIC compatible
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- Up to 9.3 MB/minute backup speed
- Includes software, minicartridge and more

At the workstation

Jumbo 250

- QIC compatible
- 125 MB native/250 MB compressed capacity
- Up to 9.3 MB/minute backup speed
- Includes software and more

Jumbo 120

- QIC compatible
- 60 MB native/120 MB compressed capacity
- Up to 4.7 MB/minute backup speed
- Includes software and more

On the move

Jumbo Trakker 250

- Parallel port interface
- QIC compatible
- 125 MB native/250 MB compressed capacity
- Up to 8 MB/minute backup speed
- Includes software and more

Jumbo Trakker 120

- Parallel port interface
- QIC compatible
- 60 MB native/120 MB compressed capacity
- Up to 4 MB/minute backup speed
- Includes software and more

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Circle 184 on reader service card.

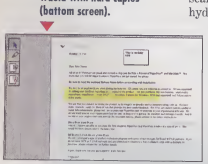
PaperMax Scanner: Document Management for Real People

SIMPLE SOFTWARE
Visioneer's MaxMate desktop makes simple document management a snap. When you initially scan a document, MaxMate creates a new, untitled

image for it on the desktop (top screen).

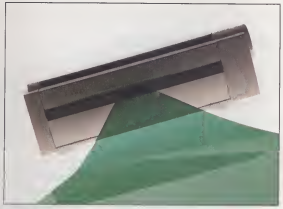
You can then stack and unstack documents. If you want to print or run OCR on a document, drag it to the appropriate icon.

Once you open a document or a stack of documents (by double-clicking), you can use MaxMate's highlighting and "sticky note" features to call out particular parts of the document exactly as you would with hard copies (bottom screen).



DROWNING IN PILES of paper? Suffocating in stacks of sheets? What you need is a fast scanner and good document management software. Today's products in this category won't propel you into the nirvana of a paperless office, but one new product takes you a long way down the golden path.

Visioneer's Paper Management System is a $499 package that includes the PaperMax personal scanner and MaxMate document management software for Windows. At first we thought this combination of a miniature scanner and software on a lone floppy disk would be ludicrously underpowered, but appearances can be deceiving. We were very impressed with the performance and ease of use of this combination and we highly recommend it to anyone interested in document management.



Small scanner, simple software: just the thing for straightening out the paper catastrophe on your desk.

The Pieces

The PaperMax, a 200-dot-per-inch (dpi) page scanner, connects to your PC's serial port. You may think that connecting a scanner to a serial port is like tapping a fire hydrant with a drinking straw—too much data, too small a pipe—but it works. This scanner easily sucks an 8½-by-11-inch text page through in two seconds.

And who ever heard of document management software that takes up just one floppy disk? Aren't these packages supposed to be big and complex? Not necessarily: The MaxMate software installs in a breeze and can manage hundreds of documents.

Here's how the combination works: MaxMate, loaded into the Windows background, monitors the scanner's port. When you feed the scanner a document, MaxMate fires itself up and starts the scanner. You'll see the scan progress in a window on your screen. As it scans the document, MaxMate straightens the electronic image. When it's completed, MaxMate places the document on its desktop. Nothing could be easier.

A Neat Desk

The MaxMate desktop mimics the sheets and piles on a real desk: You can group documents into stacks or leave them single.

If you have Calera's WordScan or WordScan Plus or Caere's OmniPage Direct or OmniPage Professional on your system, MaxMate will find it and present another desktop option: OCR. Once you've run OCR on a document, MaxMate opens your word processor and displays the result.

All is not perfect in the land of paperless filing, though: In order to stay inexpensive and easy to learn, MaxMate makes some sacrifices. For instance, although you can group documents into stacks, there is no per-page indexing or bookmark function. MaxMate does include a search function that lets you find documents by looking for particular annotation text, but you can't search within the documents.

Visioneer has a great product, and it's a steal at $499. If you think document management is out of your reach, we think this package will change your mind.

JOHN MONTGOMERY

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25-MHz 486SL ◆ 4-MB RAM ◆ 120-MB Hard Drive ◆ 9.5" Monochrome VGA Display ◆ 3½"/5¼ 1.44-MB diskette drive ◆ Power conservation and security features ◆ Preinstalled MS-DOS® 6 & Microsoft® Windows 3.1 ◆ Auxiliary Battery ◆ AC Adapter ◆ EZ Help On-Line Library ◆ Integrated Trackball ◆ Expansion Base Connector

This special Solution Paq™ offers an LTE Lite 4/25 Model 120 notebook preinstalled with WordPerfect for Windows,™ Quattro Pro for Windows, Lotus Organizer, and The Norton pcANYWHERE for Windows. You also get a Data+Fax Modem, a NiCad Smart Pack Battery, plus a carrying case.

It's set up and ready to run the moment you open the box. And by simply sliding the LTE Lite notebook into the optional Compaq Desktop Expansion Base, you have a full-function desktop computer. You also get unsurpassed Compaq quality, including a free three-year warranty[1] and 24-hour hotline support.

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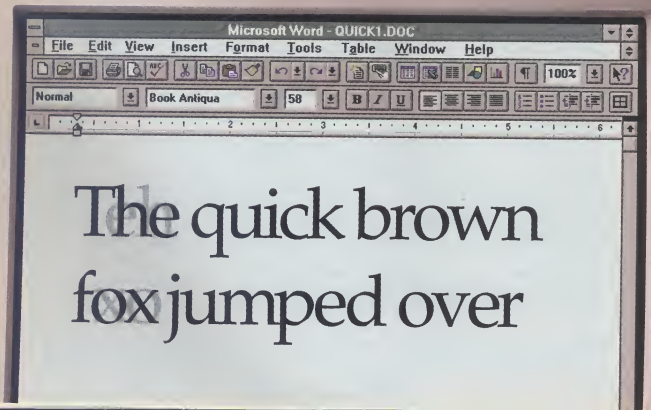
Circle 110 on reader service card.

HOW FAST WILL NEW WORD 6.0 FIX TYPOS?

HOW FAST CAN YOU MAKE THEM?



Look again. The mistakes on our screen were fixed so quickly by the intuitive new AutoCorrect feature, had you been typing this yourself, you might never have even noticed. Common typos just go away. Automatically.

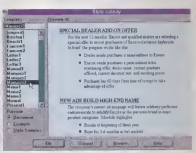
With new OfficeLinks, just a click on the toolbar icon lets you do things like add a Microsoft Excel spreadsheet to your letter without ever leaving your Word document.

We've even made converting from WordPerfect® easy – with files that convert in a snap and format immaculately. And the Help for WordPerfect Users feature guides you through equivalent Word commands when you type the WordPerfect ones.

To see for yourself why Word has become the most popular word processor in the world, hurry and visit your local reseller, or call (800) 426-9400, Dept. KT8, to find one near you.

You'll look your best faster than you can turn a page. Even if you misspell now and again.

Microsoft Word is available separately or as part of the Microsoft Office family of programs.*



(CENTER) Click the Microsoft Excel button on your Word toolbar and instantly insert a spreadsheet into Word without leaving your document. (RIGHT) AutoFormat lets you improve the look of your document with a single click.

AutoCorrect can only be found in new Microsoft® Word 6.0 for Windows™, part of the new Microsoft Office.* And it's just one sample of a whole new way to work.

We built in intelligence.

Great features like AutoCorrect are a direct result of our exclusive new IntelliSense™ technology. IntelliSense makes complex jobs easier, and everyday jobs automatic.

With AutoFormat, professional-looking formats are yours instantly. Just write your document, then let AutoFormat apply styles, bullets or headings. With a click.

More integrated than ever.

Until now, software has never truly brought your work all together.

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Cellular Modems: Please Hang Up and Try Your Call Again

SAY THAT AGAIN?
Noisy, dropout-prone cellular lines are just fine for transmitting speech because our analog brains can reconstruct meaning based on context.

For a cellular link to support data transfer, modems need something similar. Although most cellular modems use MicroCom Network Protocol 10 (MNP 10), the Motorola UDS CELLect modem, shown below, uses a proprietary protocol known as Enhanced Cellular Control.

The Nokia PC Card also uses its own proprietary error-correction protocol, called Enhanced Throughput Cellular (ETC), which the company claims provides a reliable connection 98 percent of the time. The only drawback is that for an optimal connection, you need a modem using ETC on both ends of the connection; otherwise, the KIT card will fall back to V.32bis.

FIRST THEY TRIED to sell us delicious fat-free potato chips (that tasted like crisp shoe leather). Then there was the sporty station wagon (that cornered as smoothly as a three-legged cow). Now it's practical cellular modems—we keep learning the hard way that some things really are too good to be true.

Wishful Thinking

We started out with hopes of reviewing three cellular modems. The first product, ZyXel's U-1496P Portable Cellular Modem, required a special adapter (called a tip-and-ring connector) to make the connection with a cellular phone. Unfortunately, this connector is a $300 to $400 special-order item not supplied with the modem, and at press time, we were still unable to locate one for the review.

Next, we tried Motorola UDS's Cellect 14.4 modem, a PCMCIA card that plugs into a Motorola MicroTac cellular flip-phone with a special data link cable. We gave up after trying the card in the PCMCIA slots of three computers: an otherwise perfectly reliable AMS notebook, a MidWest Micro notebook, and an IBM PS/2 desktop machine. At press time, Motorola's tech support was still wrestling with our compatibility problems.

The only modem that we could run was the Nokia PC Card, which connected to a special cradle that holds a Nokia cellular phone. With the PCMCIA socket services on our AMS notebook enabled, the Nokia PC Card could be plugged in and was instantly recognized by the system. Using Datastorm Technologies' ProComm Plus for Windows, we connected to CompuServe and several BBSes, although we were never able to make a connection with MCI Mail.

If you're really interested in cellular data communications, wait for a clearer line. Right now, the hardware is still highly proprietary. You also need big bucks—the modems will run you between

The Nokia PC card, a version of AT&T's Paradyne KeepInTouch Card, was the only cellular modem that worked in our tests.

$530 and $700, and don't forget the ridiculous per-minute costs of cellular connections. In about six months, CDPD (Cellular Digital Packet Data) service should be available, and even the proprietary radio networks like RAM Mobile Data should be less expensive. While neither is a perfect solution, at least both are designed specifically for data communications. **SHYAMALA REDDY**

U-1496P PORTABLE CELLULAR MODEM • $529 • ZYXEL • (714) 693-0808
Circle No. 623 on Reader Service Card

CELLECT 14.4 PCMCIA MODEM • $549 • MOTOROLA UDS • (800) 631-4869, (205) 430-8000
Circle No. 624 on Reader Service Card

NOKIA PC CARD • $699 (PCMCIA CARD AND PHONE CRADLE) • NOKIA MOBILE PHONES • (813) 536-5553
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ZyXel's U-1496P portable cellular modem (right) is smaller than the desktop version, but not *truly* portable.

"One Monitor Can Do It All"

BEST COLOR QUALITY: VIEWSONIC 17

"The ViewSonic 17 combines wide, smooth color range, excellent saturation and intensity, and superb uniformity for a picture-perfect image."

BEST SHARPNESS: VIEWSONIC 17

"Whether you work with text or drawings, the ViewSonic 17 will provide you with the sharpest display, even at the edges of the screen."

BEST VERSATILITY: VIEWSONIC 17

"Along with the richest colors and sharpest text and images, the ViewSonic 17 rates high in usability, thanks in part to its intuitive image controls."

BEST OVERALL: VIEWSONIC 17

"Best color quality, best sharpness and best versatility – what more could we ask of the ViewSonic 17? Frankly, we were surprised that one monitor could do it all."

(PC Computing/January 1994)

Which monitor can do it all? The ViewSonic 17! In a recent review of 13 monitors (including NEC, Nanao, Mitsubishi, and Sony), PC Computing wrote, "Frankly, we were surprised that one monitor could do it all – but our surprise will be a pleasant reward for your eyes and your budget."

Advancing into the future, our 17-inch New Generation monitor offers a flat square screen, ViewMatch color control, double dynamic focus gun, Advanced Invar Shadow Mask and a maximum resolution up to 1,600 x 1,280. And those are just some of the features that make this the monitor of choice.

To see the "Best" monitor, go to your nearest dealer and check out the ViewSonic 17. Then you'll know why it's the monitor that can do it all.

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Oddball Ethernet Adapters: Gimmicks or Good Deals?

LOCAL MOTION
Network response getting you down? If you have a local-bus computer, supercharge your throughput by putting your network card on this high-speed interface. In our tests, Xinetran's Xi-361TCVL card blew by our baseline 3Com EtherLink II.

Invisible Software's adapter turned in fairly typical numbers for a parallel port device. In fact, its performance numbers were identical to Xircom's hybrid modem/ethernet adapter (Xircom Pocket Ethernet Modem) tested in January (see "Xircom's New Breed of Network Adapter—Or Is It a Modem?" January, New! page 102).

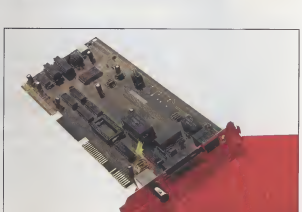
NOBODY MAKES ANYTHING simple anymore. Buying an ethernet adapter once meant choosing the color of the box, but now there are real differences among the products: local-bus ethernet cards, parallel port adapters with built-in modems, and PCMCIA adapters galore. The latest oddball adapters to cross our test bench include a local-bus card with multiple connectors and a parallel port adapter with a built-in printer connector.

Multiple Connections

Xinetron's Xi-361TCVL VL-Bus adapter isn't the first local-bus adapter we've seen, but it is the first to offer connections for thin ethernet, thick ethernet, and 10BaseT on a single board. This is great for network administrators who have more things to worry about than which type of wiring runs into which office. Beyond that, there shouldn't be a lot to say about the Xinetron Xi-361TCVL card. You should simply slip the board into a VL-bus slot, load the appropriate drivers, and you'll be up and running.

Unfortunately for novice networkers, the Xinetron card is not software configurable—you have to set the jumper switches manually, although the factory defaults work fine for a 10BaseT connection. That's primitive and inconvenient if you want to switch from 10BaseT to either of the other cable types once the card is installed.

While we can accept that an internal adapter requires a certain level of network expertise, we expect the new breed of "pocket" parallel port adapters to be suited to a less experienced user. Why put up with the lower throughput if you don't get ease-of-use and portability in exchange? Unfortunately, Invisible Software's Thruport Ethernet Pocket Adapter is a disappointment. Our review unit took several tries to install. The problem involved an obscure ethernet frame conflict in the NET.CFG file that came with the adapter, something that would send the average user scurrying for one of Xircom's many (much easier to install) pocket adapters.



Xinetran's Xi-361TCVL (above) and Invisible's Thruport Ethernet Packet Adapter (left) go beyond average ethernet cards by offering multiple cable connectors and a pass-through printer port, respectively.

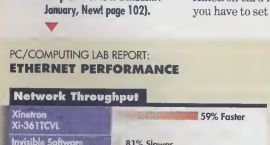
Are They Worth It?

The Invisible Software adapter's claim to fame is its pass-through printer port, which is a nice solution for small offices with limited hardware resources. In our tests, the pass-through port worked as advertised: invisibly.

We have to be honest. We were underwhelmed by the latest entries into the ethernet-and-beyond arena. The Xi-361TCVL is respectable, but we're not sure that there are many users who will pony up an extra $50 or so for its hard-to-use versatility. Nor do we think that Invisible Software's pass-through printer port is enough of a bonus to warrant its $349 price tag. Maybe next time.

SHYAMALA REDDY

PC/COMPUTING LAB REPORT:
ETHERNET PERFORMANCE



XI-361TCVL • $149 • XINETRON • (408) 727-5509
Circle No. 627 on Reader Service Card

THRUPORT ETHERNET POCKET ADAPTER • $349 • INVISIBLE SOFTWARE • (407) 260-5200
Circle No. 628 on Reader Service Card

The New Generation Monitors

ViewSonic's New Generation is everything high performance monitors should be . . . and more.

The ViewSonic 15, 17, 20 and 21 produce remarkably crisp, sharp screen images with enhanced vibrant colors. Some advanced innovations include ergonomically designed drop-down digital control panels, special screen coatings, the ViewMatch™ color control system, and resolutions up to 1600 x 1280 non-interlaced.

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Call ViewSonic at **800-888-8583** for information on our award-winning monitors.

Welcome to the New Generation.

FEATURE SUMMARY

	ViewSonic 15	ViewSonic 17	ViewSonic 20	ViewSonic 21
Screen Size	15"	17"	20"	21"
Dot Pitch (mm)	0.27	0.27	0.28	0.25
Horizontal Frequency (KHz)	30-64	30-82	30-82	30-82
1600 x 1280 Non-Interlaced		■	■	■
Maximum Refresh Rate (Hz) at 1280 x 1024 Ni	60	76	76	76
Flat Square Screen	■	■		■
ViewMatch™ Color Control	■*	■	■	■
Low Radiation (MPRII)	■	■	■	■
Suggested List	$549	$1,199	$1,899	$2,199

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ViewSonic 21 screen image by SPATIAL TECHNOLOGY INC., Boulder, CO. Created with **ACIS®** Geometric Modeler and rendered with Visualization Ilkak.

*Color temperature select 9300°K or 6550°K only.

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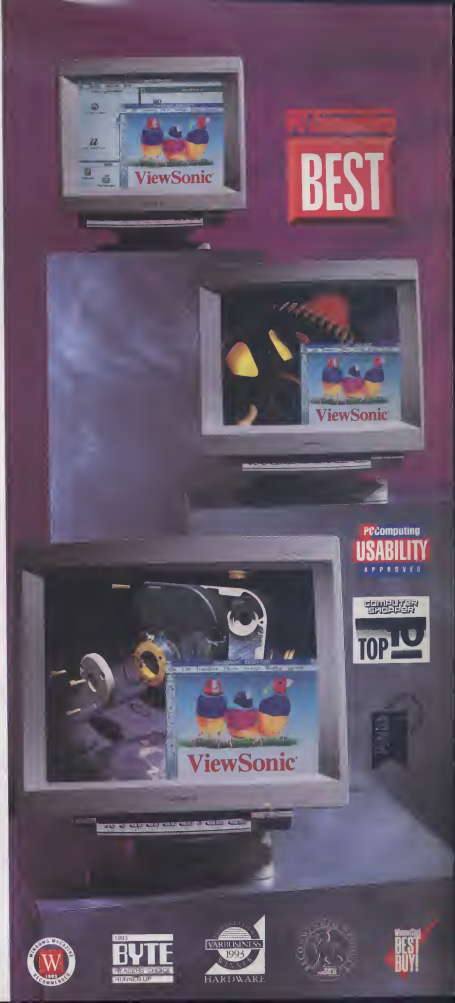
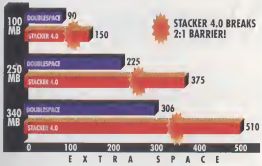


Here's the deal (compressed version): We'll beat anybody, guaranteed. ■ No catch, no special conditions. New Stacker® 4.0 for Windows & DOS will simply give you more extra disk space than any other compression software, or we'll refund your money. Period. ■ Only Stacker 4.0 breaks the 2:1 compression ratio barrier, combining Stac's patented Stacker LZS™ technology with Stacker SmartPack™ to store data more efficiently. Stacker's superior compression also allows you to store up to 3.5MB on floppy disks. ■ And the most powerful compression software is also the most full-featured



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The Realm of the Senses: New CDs Whet the Appetite, Stir the Soul

YOU CAN TRAVEL by taxi, by jet fighter, or even by time machine. Whatever your favored means of transportation, this month's harvest of CD-ROMs has something for you.

Here, once again, is our handy rating guide.

- ⊙⊙⊙⊙⊙ *We laughed, we cried, we killed a whole weekend. A masterpiece.*
- ⊙⊙⊙⊙ *Get your own copy. This is ours!*
- ⊙⊙⊙ *Justifies the dough you blew on the CD drive.*
- ⊙⊙ *We'd rather watch "Barney and Friends."*
- ⊙ *Perfect—for a skeet shoot.*

Taxi ..... ⊙⊙⊙⊙⊙

Being in a strange city is bad enough. But if the only familiar restaurant in town sports the twin arches, then you desperately need *Taxi*. It's an updated, CD-ROM version of the Zagat-Axxis CityGuide program that won a 1992 *PC/Computing* MVP Award.

Taxi includes complete maps, plus restaurant, hotel, and landmark information for Chicago, Los Angeles, New York, San Francisco, and Washington, D.C. (the big five of business trips) all on one CD. Even if you're *not* going anywhere or you already live in one of the big five, Taxi is so helpful and slick that you can spend hours using it just for the pleasure of exploring cities from your desk chair.

Where to stay and how to get there: Taxi won't steer you wrong.

You start by displaying an overall map of one of the cities. Then you can display markers for the city's restaurants, hotels, or sightseeing attractions. You click on any of the markers to get more information, drawn from the authoritative Zagat travel guides. Want to find Chinese food within five blocks of the White House at 2 a.m.? *Taxi*'s search capabilities track down the restaurants that fill the bill. Need the shortest route from the Golden Gate Bridge to the *PC/Computing* offices without getting on the freeway? Taxi figures out the route and adds it to the map, which you can print. If you don't want to haul around a CD-ROM drive to work with your notebook PC, copy the maps for any of the cities to a notebook's hard drive.

Now, here's the best part. Less than two years ago, Zagat-Axxis CityGuide, which

(Continued on page 94)

GENTLEMEN, START YOUR CD DRIVES

The nerd's revenge: Hot rod on a disk.

Back when I was growing up in the days of Richie and the Fonz, all the cool guys spent their time doing things like dropping Cadillac engines into Studebaker bodies. The classest the rest of us got to working on a hot rod was putting together plastic model cars. But today we nerds, as you know, are behind the wheels of the hottest machines of the 20th century—not Corvettes, but Pentiums.

Of course, once in a while there's a flashback to adolescent fantasies about grease beneath our fingernails and a sheepskin seat cover beneath our Levi's. But today's nerd can combine computing and automotive daydreams with *European Racers*, a combination multimedia CD *and* model car from Revell-Monogram. The model kit enclosed is the Porsche 911 Slant Nose, which is one of four cars covered in the CD, along with the Bugatti EB 110, the Nazca M12, and the Lamborghini LP500S.

The CD lets you look at exploded views of the model pieces that make up the kits, and it lets you try different body paints onscreen. It also provides instructions on assembling the model. Better yet, you can race any of the cars on four racetracks using 3-D modelling. The racing, with its different levels of difficulty, is the best feature of European Racers. Without it, the CD would wind up on a shelf as soon as the plastic model does. ..... ⊙⊙⊙

EUROPEAN RACERS • $69.95 • REVELL MONOGRAM • (800) 736-3557, (708) 390-8910
Circle No. 630 on Reader Service Card

Introducing Delrina Communications Suite. At last, powerful fax and communications software that work together.

Get a suite deal on WinFax PRO™ and new WinComm PRO™

Now you can get the world's best-selling fax software together with a powerful new communications application in one economical package: New Delrina Communications Suite™.

Together, WinFax PRO and new WinComm PRO set a new standard for ease-of-use and integration. In fact, for the first time you'll be able to run both fax and data communications software without the hassle of serial port conflicts.

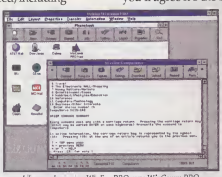
New WinComm PRO - the easy way to access on-line services and transfer files

With WinComm PRO's friendly graphical interface and intuitive icons, access to advanced communications is easier than ever. Lots of pre-defined scripts are included to automatically connect to all major on-line services, including CompuServe, MCI Mail, AT&T and GEnie. Plus, it's a cinch to record log-on scripts of your own. Or use the powerful scripting language to customize and automate all your on-line sessions. You'll find support for all the popular terminal emulations. As well as additional support for just about every file transfer protocol you might need, including Xmodem, Ymodem, Zmodem and Kermit. Plus on-line virus protection.

Only WinComm PRO gives you power and flexibility in data communications, with the same ease-of-use that made WinFax PRO number one in PC faxing.

WinFax PRO - the best way to send, receive and manage faxes

Plus, you get Delrina's award-winning WinFax PRO. With over 2 million copies of WinFax sold worldwide, we think you'll agree it's the best way to send faxes from any Windows application. It even lets you receive faxes in the background, organize your faxes with a detailed log, design your own cover sheets, and convert faxes into word processing documents with OCR.



Like award-winning WinFax PRO, new WinComm PRO gives you push button access to its powerful features.

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PCmagazine MVP AWARD 1992

As a special bonus, you get a $50 credit toward the Delrina Fax Broadcast™ Service — which lets you send the same fax to a group of people using our phone lines instead of tying up yours.

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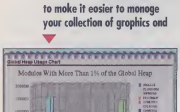
CD PowerPak

If you want to push your CD drive to the limit, get the Corel CD PowerPak. A collection of utilities on a CD, the PowerPak picks up where other CD drivers leave off, and tosses in a handful of multimedia tools to make it easier to manage your collection of graphics and



sound files. Then, because you can keep track of all those files, it throws in another CD with 100 Photo CD images and 150 sound files of music and effects.

The best feature is a replacement for the MSCDEX.EXE, the MS-DOS CD driver. Corel's version provides read-ahead caching of CD drives. MS-DOS 6.2's SmartDrive offers only read-behind caching, which doesn't give you the speed boost you get with CORELCDEX. There are other advantages to the Corel driver. If you use more than one SCSI device, which normally means you must load multiple drivers, CORELCDEX works as a universal driver to handle all the devices, saving a lot of memory.

If you work with your CD files on a daily basis, get it. You're bound to find several items in the collection to make it worth your money.

CD POWERPAK • $99 • COREL • (800) 772-6735, (613) 728-8200
Circle Reader Service No. 631

CDs, *continued from page 92*

covered only New York, cost $250. The *Taxi* CD, with all five cities, is $79.95, which is the best real-estate bargain you'll find in any of these cities.

The Journeyman Project ..... ⊙⊙⊙⊙⊙

Good multimedia is easy to use, informative, helpful—all that boring but necessary stuff. *Great* multimedia stirs something in your bones. It has you lying awake at night wondering if you could sneak back downstairs to the computer for a while and show up late to the office tomorrow. That's what *The Journeyman Project* does.

The essential ingredient in *The Journeyman Project* that's missing from most other software—even from other games—is imagination. This adventure game's plot itself is worthy of a page-turning science-fiction novel: In the 21st century, mankind has achieved worldwide peace, but it's threatened by the building of a time machine that can be used to undo history. The player's role is to act as one of the members of the Temporal Protectorate, whose job is to travel back in time to correct attempts to change Earth's destiny.

The basic setup mixes adventure-game roaming and exploration with arcade action enhanced by full-motion animation and video. But *The Journeyman Project*'s creators have given so much attention to the minutiae that you can happily while away an evening just exploring your character's apartment building. Every turn is filled with dry humor satirizing everything from DJs to land development come-ons, but—and this is important—the jokes are really funny, not like pun-burdened clunkers that too often pass for humor in multimedia games.

Any complaints? Well, *The Journeyman Project* works almost entirely from CD, so it's slow. And the 3-D interface usually consists of abrupt cuts from one view to another instead of smooth 3-D animation. But despite that, *The Journeyman Project* is destined to be a classic.

Dr. Schueler's Home Medical Advisor Pro ..... ⊙⊙⊙

OK, here's the real reason you buy *Dr. Schueler's Home Medical Advisor Pro*: You want to see close-up, color photos of really gross medical stuff—wooden stakes stuck through some guy's leg and red, bulging protrusions on intimate parts of the body.

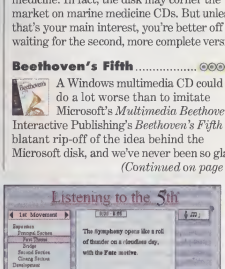
The Windows CD is filled with stills and video that Beavis and Butt-head would giggle over, but if you get *Home Medical Advisor Pro* because you're a practicing hypochondriac who wants to confirm that the rash on your foot is really a fatal disease you're going to be disappointed. Its medical advice is uneven and at times misleading. We're old enough to have had enough ailments to keep a medical class studying all night, and this Windows program failed to correctly identify any of our symptoms. The folks at Pixel Perfect explained that our particular maladies were relatively rare, and this first edition of the CD tries to hit the more common problems. But a disk like this needs to be inclusive. You wouldn't go to a doctor who could diagnose only half your symptoms. Its pharmacological section did a better job at identifying some potentially dangerous drug interactions, but none of the search information is retained so that you can check the same drugs in other combinations.

There is a good section on poisons that could be helpful in an emergency. And, inexplicably, it has a large section on marine medicine. In fact, the disk may corner the market on marine medicine CDs. But unless that's your main interest, you're better off waiting for the second, more complete version.

Beethoven's Fifth ..... ⊙⊙⊙⊙

A Windows multimedia CD could do a lot worse than to imitate Microsoft's *Multimedia Beethoven*. Interactive Publishing's *Beethoven's Fifth* is a blatant rip-off of the idea behind the Microsoft disk, and we've never been so glad

(Continued on page 99)



***This* is the way to learn music: *Beethoven's Fifth* walks you through the score.**

Multimedia without the mumbo jumbo.

And we'll deliver it loaded, tested and ready to run.

John Craig
PC Consultant

Get the right answers. Right away.
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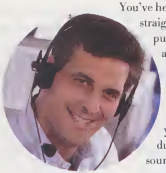

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- Microsoft Works™ for Windows
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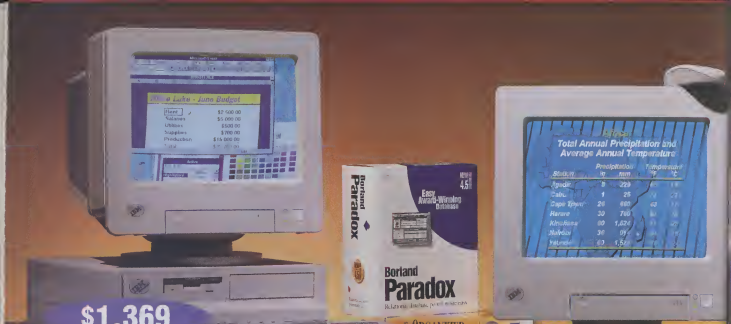

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425SX/Si
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14L8 (IBM Credit Lease: $50/mo.**) $1,369*

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14L8 (IBM Credit Lease: $62/mo.) $1,719*

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486DX/33MHz,[3] 212MB HD, 4MB RAM
14L8 (IBM Credit Lease: $66/mo.) $1,829*

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486DX/33MHz,[3] 212MB HD, 4MB RAM
14L8 (IBM Credit Lease: $70/mo.) $1,939*

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i486DX2/50MHz, 340MB HD, 4MB RAM
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CDs, *continued from page 94*
to see thievery. Like its inspiration, *Beethoven's Fifth* presents the symphony complete with text that explains what's happening musically as the symphony is being played. There's also the required extras—a biography of Beethoven, a glossary of musical terms, and an orchestra seating chart where you can sample various instruments. Unfortunately, to hear the music you have to use headphones or have a separate connection from your CD drive to the speakers, and the glossary is rather difficult to search. But those complaints are in a minor key.

The Musical World of Professor Piccolo ..... ◎◎◎

Adults will go for *Beethoven's Fifth*. If you have children who are just getting into music, a good Windows CD is *The Musical World of Professor Piccolo*. A user visits the symphony hall, rock or jazz clubs, a church, library, or school to learn more about different forms of music. *Piccolo* does for a rock ballad and a jazz improvisation what the Beethoven disc does for classical music. It's presented simply enough that any child old enough to take an interest in music can understand the explanations. But it's informative enough to hold the interest of the adults who tested it.

Supersonic ..... ◎◎

There are men who look at a photograph of the sleek lines of an OH-58D Kiowa Warrior helicopter the same way as they look at the centerfold of *Playboy*. We don't try to understand these people. We're just here to report that if fighting aircraft make you drool, *Supersonic* is the ultimate in soft porn. It's packed with still photos and videos of fighter jets and helicopters with detailed data on their capabilities and firepower, which we're guessing is the equivalent of reading about Miss February's turn-ons. It also includes some rudimentary games and an "interactive" portion in which you take off in a plane only after turning on all the right switches and checking all the dials. Flight Simulator it ain't. But if it turns on your thrusters. . . .

Just look at the thrusters on this baby. . . . If this turns you on, get *Supersonic*.

Great Mystery Classics ..... ◎

We're including *Great Mystery Classics* only as a warning to CD-ROM publishers: You can't get away with this much longer. There was a time when CDs were new and people with CD drives would buy anything. Enterprising companies made a fast buck by scanning in a bunch of public-domain books, adding a search engine and stamping it all onto a CD.

The only possible use that the combination Windows and DOS *Great Mystery Classics* can have is for a student doing a thesis on Sir Arthur Conan Doyle who needs to electronically search the Sherlock Holmes stories to find out how often Dr. Watson's name is used. The disk includes 171 stories, novels, and poems, but we're not impressed. You can't read these mysteries the way they should be read—curled up in bed with a box of crackers. CD today means multimedia—and it better be meaningful multimedia, not just some photos of Edgar Allen Poe and Nat Hawthorne. If you publishers can't do better than this, don't even try.

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Spotlight

Greening That PC

No need to buy a whole new computer to get the financial and karmic benefits of joining the green PC revolution. Instead of ponying up for one of the new energy-sensitive PCs, just get one of these new add-ins or add-ons, which turn your current PC monitor into a good environmental citizen.

Monitor Saver reduces the power draw of your display to less than a watt following a period of inactivity that you specify. It does this by monitoring keyboard and mouse signals and turning off your display's cathode-ray tube heater after 5 to 30 minutes of inactivity. A keystroke or mouse movement powers the monitor back up, albeit after a somewhat annoying delay of 5 to 8 seconds. ($59.95; Cypress Computer; 800-728-6688, 510-786-9106)
Circle Reader Service No. 648

Power Miser by Tripp Lite is a slightly more ambitious (and expensive) solution that adds surge suppression for three additional devices and regulates the power to your monitor. Power Miser actually turns your monitor off, so expect the kind of screen delay you get when turning on a cold monitor in the morning. ($99.95; Tripp Lite; 312-329-1601)
Circle Reader Service No. 649

If you've purchased a new monitor relatively recently and its documentation indicates Display Power Management Signalling (DPMS) compliance, **Opti-Green** can provide an inexpensive software solution. This Windows utility will let you turn your monitor's power usage down to 20 watts after as little as one minute of inactivity, and then some time after that down to less than 5 watts. ($29.95; Optiquest; 800-843-6784)
Circle Reader Service No. 650

Your utility bill savings will vary widely depending on the product, your work habits, and the duration of your computer usage. But if you're in the habit of leaving your high-wattage monitor on overnight, you could save up to $100 a year.

BRIEFLY NOTED: HOT PRODUCTS AND UPGRADES.

BY MIKE HOGAN

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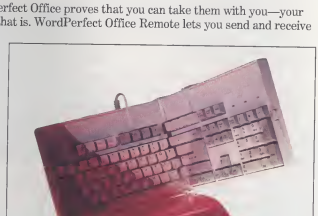
If your audiences are drifting off to dreamland during your presentations, give 'em a wake-up call with fresh Freelance Graphics SmartMasters, including a fill-in-the-blanks meeting agenda, project updates, and a collection of backdrops with an international flavor. All in all, Lotus gives users a total of 101 looks to choose from, as well as 34 clip-art images, including international currency symbols and an instant classic—a candle burning at both ends. ($10 to cover shipping and handling; Lotus Development Corp.; 800-343-5414)
Circle No. 640 on Reader Service Card

WordPerfect Office Remote

This add-in module for WordPerfect Office proves that you can take them with you—your workgroup productivity tools, that is. WordPerfect Office Remote lets you send and receive e-mail and utilize e-mail filters on your portable, as well as schedule meetings and tasks, and get calendar updates for yourself and your co-workers. This program also provides mobile users with full access to WordPerfect Office's workflow features. ($495 per five-user pack; WordPerfect Corp.; 800-861-2507)
Circle Reader Service No. 641



A Space-Saving Cover-up Keyboard
An exposed keyboard attracts tons of dust, spills, and free-floating gunk. And who remembers to drag out the dust cover at night? Nobody. Who even wants an 18-inch wide slab of plastic always cluttering the desk? Not us. The self-protecting FKB-01 keyboard stays clean and saves space by folding over onto itself, leaving only a 10-inch wide footprint. Otherwise, it's a full 101-key IBM-style keyboard with 4mm key travel. ($69; Golden Pacific Electronics; 714-993-6970)
Circle No. 671 on Reader Service Card

Ami Pro 3.0 for OS/2

While it's taking a long time to build a decent base of applications for OS/2, no company (except IBM, perhaps) is pursuing that goal with more vigor than Lotus Development. Ami Pro 3.0 for OS/2 joins other popular applications in Lotus's SmartSuite by exercising OS/2's unique features: 254-letter filenames in a highly graphical, high-performance file management system; 32-bit linear memory addressing; and multithreading of applications. Ami Pro 3.0 for OS/2 shares macros with 1-2-3, Freelance Graphics, and cc:Mail in SmartSuite and lets you send and receive messages via cc:Mail and Lotus Notes without leaving your document. ($495; $129 for upgrades; Lotus Development Corp.; 800-831-9679, 404-391-0011)
Circle No. 642 on Reader Service Card

New Online Service from Ziff

Ziff-Davis Interactive is currently beta testing a new online information service, code-named Interchange. Scheduled for a full commercial rollout on October 1, it lets users download software, read reviews, or engage in online discussions—all under a fully graphical interface. And because all of the information on the service is linked, users can easily navigate through related data—first reading a review of a shareware product, then downloading it, for example—with the click of a button. Watch this space in the coming months for more information on subscribing to and using Interchange.

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Now – want to carry off color with ease? Then call us about the ThinkPad 350C. You get a 9.2" backlit, 256-color, passive-matrix LCD display. There's plenty of power for your current needs. And ample space to upgrade for more. All in an easy-to-take 5.7-pound package. Both of these lightweights get the heavyweight backing of IBM's HelpWare®, including a 30-day moneyback guarantee[1] and around-the-clock telephone assistance.[2] You'll find them at IBM PC Direct. To order these, or any of our other critically acclaimed IBM ThinkPads, call now.

ThinkPad 500

- 486SLC2, 50/25MHz processor with 16KB internal cache
- 4MB RAM/85MB hard drive
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- 7.4" monochrome passive-matrix LCD display, 64 grey scales
- 81-key keyboard w/integrated TrackPoint
- PCMCIA slot
- IBM DOS preinstalled
- 1-year international traveler's warranty[2]

$1,999* (IBM Credit Le $72/mo.**)

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ThinkPad 350C

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ThinkPad 350C (color)

- 486SL, 25MHz processor with 8KB internal cache
- 4MB RAM/250MB hard drive, 3.5" 1.44MB diskette drive
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- 9.2" STN backlit LCD, 256-color display
- Full-size keyboard w/integrated TrackPoint II
- PCMCIA slot
- IBM DOS preinstalled
- 1-year international traveler's warranty[2]

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- 9.5" monochrome STN backlit LCD display, 64 grey scales
- Full-size keyboard w/integrated TrackPoint II
- PCMCIA slot
- IBM DOS preinstalled
- 1-year international traveler's warranty[2]

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Short Takes

The **Hayes Smartmodem Optima 14400+ Fax144 Packet Edition PCMCIA** fax modem has had $200 shaved off its price. The 2.5-ounce notebook modem transfers data at up to 57,600 bits per second (bps) under ideal conditions and faxes at 14,400bps. ($399; Hayes Microcomputer Products; 404-441-1617)
Circle Reader Service No. 651

The **Majar BBS Version 6.2** supports both intelligent and nonintelligent multiport serial cards for multiple inbound phone lines. It also includes improved file transfers and a QuickStart booklet to help novice system operators get up to speed. ($259, varying prices for upgrades; Galacticomm; 800-328-1128, 305-583-5990)
Circle Reader Service No. 652

TurboTax Tax Savings Guide provides more than 250 suggestions for saving money on your 1993 taxes. The interactive program collects personal information and makes specific suggestions based on that information. ($19.95; ChipSoft; 800-964-1040)
Circle Reader Service No. 653

RAM Mobile Data offers a new tiered pricing system, enabling you to use your portable to send and receive up to 100K worth of wireless e-mail messages a month for $25 (25 cents per message thereafter). Or you can opt for a plan in which you pay $75 per month for up to 400K worth of messages (20 cents per message after that) or even unlimited messaging for $135 per month. (RAM Mobile Data; 800-662-4839, 908-602-5444)
Circle Reader Service No. 654

The **14400 ETC-Express PCMCIA** fax modem—with data speeds of 14,400bps and fax speeds of 9,600bps—is now $150 cheaper. Its bundle includes both FaxWorks fax software and Camit for Windows communications software. ($349; ATI Technologies; 905-882-2600)
Circle Reader Service No. 655

Golden Retriever

The file manager that should have been designed into Windows in the first place, Golden Retriever permits filenames of up to 256 characters with real punctuation, as well as keyword or text-string searches and graphical file drawers for directories. Version 2.0d extends those functions to NetWare and Windows for Workgroups networks. Golden Retriever intercepts file commands to provide consistent functionality for any Windows application, and it supports extended features such as drag-and-drop printing of multiple files and the maintenance of multiple file versions. ($99; Above Software; 800-344-0116, 714-851-2283)
Circle No. 643 on Reader Service Card

ReachOut Remote Control Pro Version 4.0

Not only can you reach out and control your office PC from your home or on the road with the new version of ReachOut Remote Control Pro Version 4.0, but you also can work on one Windows application while monitoring the work of a co-worker. This remote multitasking software supports the Windows clipboard on both PCs. Version 4.0 provides a 40 percent performance improvement over the earlier version, and supports TCP/IP and high-resolution monitors. ($199; Ocean Isle Software; 800-677-6232, 407-770-4777)
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Conversions Plus 2.0

If you're a Windows user who regularly exchanges files with a Macintosh, or even someone who needs to swap files with users of other DOS and Windows applications, you need Conversions Plus. Version 2.0 includes more than 700 file-translation combinations, including support for the formats of new programs like ClarisWorks for Windows and WordPerfect 6.0. In addition to simultaneous bidirectional conversions, Conversions Plus lets you mount Mac disks to view and perform common file-management activities using Windows File Manager or DOS commands. The program faithfully preserves formatting and embedded graphics across platforms, and lets you launch the application associated with a file once conversion is completed. ($149, free upgrades; DataViz; 800-733-0030, 203-268-0030)
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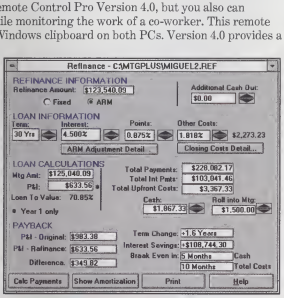

MortgagePlus/Tracker

Rates, points, indexes, margins, monthly payments—MortgagePlus/Tracker steps you through the entire financing/refinancing process. You get quick answers to critical questions like which loan will cost the most, how much you can save every month by refinancing, and how long it will take to amortize refinancing costs. Finally, a program that helps you understand what your loan officer is saying. ($40; BitBrain Software; 215-882-2341)
Circle No. 672 on Reader Service Card

Personal Dictation System

Finally, you can tell your PC what's on your mind: IBM's Personal Dictation System lets you bark voice commands at several of the most popular applications running under Windows and OS/2, as well as dictate letters and memos at up to 70 words per minute. The IBM Personal Dictation System's 32,000-word vocabulary with additional profession-specific add-ins lets you interact smoothly and naturally without putting fingers to keyboard or mouse. You also can create your own voice-activated macros. ($998; IBM; 800-426-2255)
Circle No. 647 on Reader Service Card

PEOPLE WHO HAVEN'T EXPERIENCED OUR 1-2-3 WORKGROUP FEATURES PROBABLY HAVE A FEW QUESTIONS.

The problem is this: while many people might need to work on the same spreadsheet data, most spreadsheet software can't manage this process. Only Lotus® 1-2-3® Release 4 for Windows™ lets you share data and ideas, collaborate with co-workers, and work the way you work best – in a team.

It starts with the powerful Version Manager™ technology built into 1-2-3 Release 4. As a spreadsheet changes, Version Manager tracks the changes, when they were made, by whom, for what reason. You can see the thinking that went into the spreadsheet. So you get better decisions out of it.

1-2-3 AND NOTES – THE ONLY WORKGROUP SOLUTION.

And 1-2-3 works seamlessly with Lotus Notes,® the market-leading groupware. Notes replicates the 1-2-3 document across the network so that everyone, even remote users, can access and work on the same document concurrently. And Notes sends instantaneous notification as changes are made. For 1-2-3 users, it couldn't be simpler – you don't need to know Notes at all – just how to save a file in 1-2-3.

Then there's Notes/FX,™ integration technology that goes beyond DDE and OLE, to let you build the power of 1-2-3 into your Notes applications. With a single click from Notes you can launch a 1-2-3 template that's already filled in with key information from the Notes database. Then, changes to the 1-2-3 template are updated in the Notes document for unparalleled two-way integration.

Of course, 1-2-3 Release 4 features close integration with the other Lotus applications that make up Lotus SmartSuite.* So, for example, it's easy to pull 1-2-3 data into Ami Pro® for word processing or Freelance Graphics® for a presentation.

And right now you can upgrade to either 1-2-3 Release 4 or our new 1-2-3 Release 4: Multimedia Edition delivered on CD-ROM for just $119. Or for an even better deal upgrade to SmartSuite for just $299.* Visit your Lotus Authorized Reseller or call **1-800-TRADE-UP, ext. 9405**** to upgrade or to order a free demo disk.

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*$299 promotional price available while supplies last. **In Canada, call **1-800-GO-LOTUS**. Prices may vary. ©1994 Lotus Development Corporation, 55 Cambridge Parkway, Cambridge, MA 02142. All rights reserved. Lotus, 1-2-3, Working Together, Lotus Notes, SmartSuite, Ami Pro and Freelance Graphics are registered trademarks and Notes/FX and Version Manager are trademarks of Lotus Development Corporation. Windows is a trademark of Microsoft Corporation.

New!

BEST BETS

TOP DEALS FOR YOUR PC.

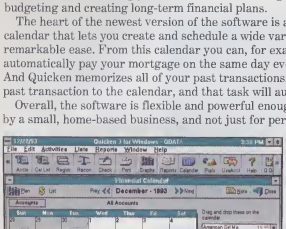
BY PRESTON GRALLA

Try Quicken Personal Finance Software for $8

If you've been stalling on investing in personal finance software, now is the time to try it, because the industry's best-seller has an offer you won't be able to refuse: a trial version of Intuit's best-selling Quicken for DOS or Windows for $8. Quicken lets you handle virtually every aspect of your finances, from balancing your checkbook to tracking your portfolio to budgeting and creating long-term financial plans.

The heart of the new version of the software is an innovative financial calendar that lets you create and schedule a wide variety of financial tasks with remarkable ease. From this calendar you can, for example, have the software automatically pay your mortgage on the same day every month of the year. And Quicken memorizes all of your past transactions, so that you can drag a past transaction to the calendar, and that task will automatically be performed.

Overall, the software is flexible and powerful enough so that it can be used by a small, home-based business, and not just for personal finance. The Quicken Trial Edition does almost everything that the full-blown version of Quicken does. The only differences are that you can set up only eight accounts, and you are limited to only 50 transactions per account.



You can order the Trial Edition of Quicken for DOS or Windows directly from Intuit at (800) 624-5071.

Circle Reader Service No. 656

BEST SOFTWARE BUYS

Where can you get the best software deal? Usually through the mail. We surveyed mail-order houses and came up with the best prices we could find. The following prices include shipping and handling charges, but don't include credit card surcharges. Prices are as of press time and are subject to change.

PRODUCT	LIST PRICE	BEST PRICE	SOURCE	READER SERVICE NO.
Excel 5.0	$495.00	$289.00	Lomo, (800) 369-2846	660
Lotus 1-2-3 4.0	$495.00	$320.00	Telemart, (800) 537-4735	661
Microsoft Word 6.0	$495.00	$260.00	Lomo, (800) 369-2846	662
MS-DOS 6.2	$80.00	$49.00	MicroWarehouse, (800) 367-7080	663
Norton Utilities 7.0	$179.00	$112.00	Owsfin, (800) 477-3878	664
QEMM 7	$99.00	$55.00	Egghead, (800) 344-4323	665
Quattro Pro 5.0	$99.00	$45.00	CompUSA, (800) 451-7638	666
Windows 3.1	$149.00	$79.00	MicroWarehouse, (800) 367-7080	667
Word 6.0 for Windows	$495.00	$298.00	Lomo, (800) 369-2846	668
WordPerfect 5.2 for Windows	$495.00	$269.00	Computability, (800) 558-0003	669
WordPerfect 6.0	$495.00	$270.00	Egghead, (800) 344-4323	670

PCContact

Unbeatable Deal On A Graphics Viewer

Need a cheap and easy way to view your graphics files? Look no further: LView lets you view and edit graphics files in a variety of formats, including JPEG, BMP, GIF, TGA, and DIB. The program lets you flip and rotate images, retouch and resize them, add text, enhance contrast, and even apply a smoothing filter. Best of all, it's free. You can download LView from *PC/Computing*'s online service on ZiffNet, PC/Contact, as file LVIEW.ZIP from data library 3 (Utilities/Misc.).

Check Out Tax Software—Free

Here may be the best deal you'll ever find for tax software: You get the software free, and if you decide you want it, you pay only $20. AM Tax handles the IRS Form 1040 and a full complement of schedules, including A, B, C, D, E, and others. You can download AM Tax from PC/Contact, *PC/Computing*'s forum on ZiffNet, as AMTAX.ZIP, or order it for $20 from AM Software, P.O. Box 25010, Kansas City, MO 64119. For $39, you can get the personal version, which has more forms than the shareware version.

Circle No. 658 on Reader Service Card

Test Windows Drawing Program Free; Buy It for $39.95

Good news for people who are interested in a simple-to-use Windows drawing program: You can test drive a copy of Top Draw drawing software free. It includes a full complement of drawing tools and extras such as the ability to work in layers and annotate drawings with text. You can download Top Draw from PC/Contact as TOPDRW.ZIP or order it for $39.95 from Top Software, P.O. Box 1141, Conifer, CO 80433.

Circle No. 659 on Reader Service Card

It's a Fax Machine, Document Reader, Image Enhancer ...Oh yes, and a Scanner.

The ScanMaker IIG scans at resolutions up to 300 X 600 dpi optical resolution; 1200 x 1200 dpi (software interpolated).

Introducing The Very Affordable ScanMaker® IIG from Microtek.

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Microtek has a long history of making innovative, high-quality products available at very competitive prices. A perfect example is the **new ScanMaker IIG** Grayscale Flatbed Scanner — the lowest priced flatbed scanner available.

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And every ScanMaker IIG for the PC[1] includes Caere Corporation's powerful new **OmniScan® Software Edition** which combines three powerful software packages into one integrated and easy-to-use program.

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For more information about the Microtek ScanMaker IIG or for the name of your nearest authorized Microtek retailer, call **1-800-654-4160**.

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1 Every ScanMaker IIG for the Macintosh comes only with **Fractal Design Sketcher 1.0**.
2 Requires fax cord.

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A new level of integration.

You want products that work well together. Ours do. With PerfectFit Technology, they have common icons, button bars, and cross-application macros, as well as resources like spell checking. So each product "looks and feels" the same.

And where other suites stop at integrating your applications with OLE, we also integrate your people. The Borland Office is the only suite that's workgroup-ready right out of the box. So you can automatically share data. Anywhere.

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The Borland Office gives you the ease of a single installation procedure, "coaches" that teach you, and the best compatibility with DOS products. Plus, we offer the best technical support in the industry.

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Software Saleswire

Cheap font packs and screen savers drive a thriving consumer market.

Apps Go AWOL
WinFax Pro and Lotus 1-2-3 Release 4 drop out of the business top ten for the first time in more than a year.

BUSINESS APPLICATIONS	VENDOR	PRICE	COMMENTS	NOV	DEC
Word 6.0 for Windows	Microsoft	$495	AutoFormat allows for preset styles.	8	1
Excel 4.0 for Windows	Microsoft	$495	Customizable toolbar capabilities.	3	2
PowerPoint 3.0 for Windows	Microsoft	$495	Directly reads Word and Excel files.	11	3
WordPerfect 6.0	WordPerfect	$495	Supports four scalable font families.	1	4
Paradox 4.5 for Windows	Borland	$150	Supports native dBASE file formats.	4	5
Quattro Pro 5.0 for Windows	Borland	$50	Has 350 scientific and financial functions.	5	6
Procomm Plus 1.x for Windows	Datastorm	$180	Offers ten error-correcting protocols.	13	7
Procomm Plus 2.01	Datastorm	$130	Enhances Dialing Directory with sorting.	6	8
Access 1.1 for Windows	Microsoft	$495	Wizards speed report creation.	2	9
Publisher 2.0 for Windows	Microsoft	$199	Easy-to-use desktop publishing.	7	10

An OS/2 Debut
IBM's OS/2 2.1 for Windows leaps into the spotlight, outpacing an absent Microsoft Windows NT 3.1.

UTILITIES	VENDOR	PRICE	COMMENTS	NOV	DEC
MS-DOS 6	Microsoft	$129	Improved backup eases data protection.	1	1
QEMM-386 7	Quarterdeck	$100	Supports multiple configuration files.	3	2
After Dark 2.0 for Windows	Berkeley Systems	$50	Sound Blaster and multimedia support.	5	3
Windows 3.1	Microsoft	$149	Drag-and-drop capability built in.	2	4
Disney Screen Saver	Berkeley Systems	$50	The Little Mermaid takes a dive.	4	5
Norton Utilities 7.0	Symantec	$179	Speed Disk optimizes compressed files.	7	6
Adobe Type Manager Font Pack	Adobe	$149	Includes 65 Adobe fonts.	-	7
Expert Fonts for Windows	Expert	$15	120 Wysiwyg, TrueType fonts for cheap.	-	8
PrintCache 3.1	LoserTools	$100	Printer buffer speeds printers of all types.	-	9
OS/2 2.1 for Windows	IBM	$224	Includes 32-bit graphics engine.	23	10

Money to Burn
Intuit's acquisition of ChipSoft last fall has created a financial software titan, holding six of ten titles.

PERSONAL PRODUCTIVITY	VENDOR	PRICE	COMMENTS	NOV	DEC
Quicken 7 for DOS	Intuit	$70	New Financial Calendar feature.	1	1
TurboTax Personal 1040	ChipSoft	$70	Miscalculation? ChipSoft pays a fine.	6	2
Quicken 3.0 for Windows	Intuit	$70	Automatically categorizes transactions.	2	3
Quicken Companion 2.0	Intuit	$35	Updates financial markets online.	4	4
TurboTax Personal 1040 for DOS	ChipSoft	$70	New Deduction Finder feature.	-	5
CompuServe Membership Kit	CompuServe	$50	Compose mail messages offline.	7	6
Money 2.0 for Windows	Microsoft	$70	Electronic bill paying for $9.95 monthly.	8	7
QuickBooks 2.0	Intuit	$140	QuickFill eliminates repetitive data entry.	5	8
Calendar Creator Plus	Spinnaker	$80	Event scheduler with format flexibility.	9	9
Print Shop Deluxe	Broderbund	$80	Customize graphics with color or shading.	3	10

These software charts are compiled once each month after gathering ranked-order sales information supplied by the following software industry sources: 800-Software, ABCO Distributors, American Software, Babbages, Baker and Taylor Software, CompUSA, Computability, Computer Discount Warehouse, Corporate Software, Dustin Discount Software, Egghead Discount Software, Electronics Boutique, Gate/FA, Ingram-Micro, Jasho Distributing, Kenfil, Lusk International, Merisel, Multiple Zones, Navarre, PC Connection, Software Resource, Software Spectrum, Software, Etc., and Woldensoftware. They represent sales through tens of thousands of resellers and more than $6 billion of software sales. A weighting system is applied to each entry based on three factors: the entry's position in the individual chart, the power of the contributing source based on annual gross sales, and the relative strength of a source in a given category of software. All prices are suggested retail and are subject to change.

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MacBravo! users ...

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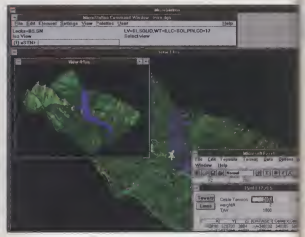
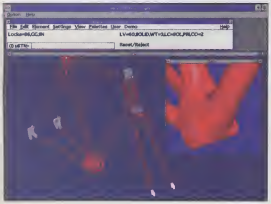
Rendering. Visualization and flythroughs – at your fingertips! MicroStation offers photo-realistic rendering to every designer, right in the software. It's easy to make your image reflect your imagination.



Windows. It walks and talks Windows. Behind MicroStation lies the user-responsive programming you look for in good Windows software. Version 5 gives you the ultimate in integration of CAD, engineering, and business applications.

MORE POWER TO YOU.



Modeling. Model any surface you can imagine in MicroStation. NURBS surface modeling combined with 3D Boolean operations gives you astounding flexibility in creating and modifying freeform models.

Drafting. MicroStation gives you first-rate drafting power – without the limitations of old technology. Enjoy the advantages of contemporary features like associative patterning/hatching, plot preview, standard text editing, fonts, and context-sensitive Hypertext help.

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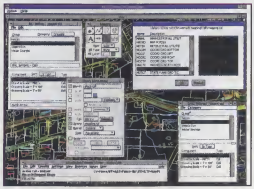

Workspaces. Choose the design environment that matches your profession or your CAD expertise – even AutoCAD. Complete with custom interfaces, drafting styles, and design environment management. CAD has never been so streamlined!

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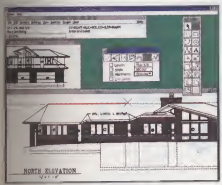
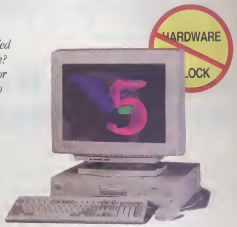


Usability. *What does computer-aided drafting have to do with the way you think? Everything. MicroStation software works for you. It understands the drafting process so well that it infers what you'll do next.*



Power. *Take your pick of popular environments: DOS, Mac, Windows, Windows NT, or UNIX. Have a look at MicroStation on Intergraph's Technical Desktop Series personal workstations.*

Graphical User Interface. MicroStation's easy-to-use interface includes pull-down menus, dialog boxes, tear-off tool palettes, and tool settings window. Choose your interface – Windows or Motif – on any platform. *Transparent Modeless Operation.* The software supports the way you naturally work, maintaining command execution while you fine tune: change element attributes or command parameters, manipulate views, change the dimensioning system, and more. *Powerful View Manipulation.* MicroStation supports up to eight active views that can be moved, sized, and overlapped to fit your design. Zoom and area at any scale. Move around your design fast with built-in dynamic panning. *Workspace Editor.* Tailor pull-down menus, dialog boxes, and tool palettes – even disable commands – with a graphically oriented toolset for customizing your chosen interface. *Text Capabilities.* A convenient text editor lets you easily edit single-line or paragraph text. Choose from TrueType, PostScript, AutoCAD SHX, and MicroStation fonts. ASCII text files can be imported and exported. *Multiple Undo/Redo Commands.* Undo mistakes and perform "what-if" designs in a flash with unlimited undo and redo. *Plotting.* Plot raster and vector information by view or defined areas, at any scale. Visually preview the plot before plotting, saving time and materials. *Online HELP.* MicroStation's HELP remains active, tracking the command you're currently using, so there's no searching through manuals for assistance. *Associative Patterning and Hatching.* Associate patterning with graphics. Change graphics and the patterning updates. Flood-fill hatching/patterning intelligently fills an area, detecting boundaries and holes with a single pick. *Associative Dimensioning.* Dimensions are associated with the geometry, not with a point in space, so that when you change the geometry, the dimensions automatically update. *Custom Line Styles.* Create space-saving custom line styles and place railroad tracks, trees, isobars – anything – just as you would place a line. *Multi-lines.* Define line string elements comprising up to 16 parallel lines of varying symbology and store them in a style library to recall. Architects can use multi-lines for fast and easy placement and intersection cleanup of walls and partitions. *2D Boolean Operations.* Quickly modify, measure, and hatch multiple 2D shapes with integrated Boolean operations. *Mass Properties.* Calculate area and properties of your model: surface area, volume, mass, centroid, moments and products of inertia, principal moments and directions, and radii of gyration. *Relations.* Define relationships among graphic entities with intuitive drawing modes such as tangent, parallel, perpendicular, midpoint, intersection, and end-point. *Dimension-driven Symbols.* Based on established relationships, you can assign variables to dimensioned graphics and save the graphics as cells

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Who Cares How Big Apps Are? 5GB CD-ROMs Are Coming

THE PROLIFERATION OF CD-ROM OVER THE NEXT TWO YEARS will forever change the profession of programming, the quality and reliability of code, and the economics of computing.

With a CD-ROM and its 600-plus megabytes of storage, the need for clever programming and tight code is over. Today's bloated C++ programs have already penetrated the market with their 10-disk installations, but you haven't seen anything yet. Bloat is in your future.

In one of my public speeches, I used the joke that the CD-ROM and larger address spaces of today's computers have encouraged oversized code. "In the future as we use up the allotted space, even larger address spaces will be needed to accommodate code written in C++++++++++."

I recently discussed some of these issues with *PC/Computing*'s new Help columnist, Robert L. Hummel, who is himself a clever programmer of the old school and the author of numerous books on assembly language programming. His take was the opposite of what I expected.

Assembly Language Lament

I reckoned that a guy like this would moan about the death of good code and about how tight code will be lost forever to the detriment of us all. Over the years there has been a lament amongst pundits and columnists about the issue of assembly language vs. high-level languages (HLLs). The argument boils down to this: Assembly is good, and everything else is bad because HLLs produce crummy performance. In the days of 100,000 instructions per second, this was obvious. But as the performance of small machines hit 1 million instructions per second (MIPS), it was harder to tell the difference between tight code and bloated code. Now, with the next generation heading toward 100 MIPS, the performance issue fades fast for almost every application. Even the sluggish image rendering and image manipulation programs will be speedy as the processor gets even faster.

Bloated code could mean more reliable code in the future.

Well, Hummel didn't moan. He believes, as many of us are beginning to believe, that bloated code running off CD-ROMs is a benefit. Hummel says everything will be table-driven, and the program simply looks for things in huge tables that can easily fit onto a CD-ROM. This will be combined with the death of the If-then-else instruction, where programs have to constantly make decisions based on peculiarities of machines. If color then . . . If monochrome then . . . If 1,024 by 768 then . . . If sound then . . . If this then that.

You can have dedicated program modules for every combination of machine on a CD-ROM, all compiled separately. Running Windows and 1,024 by 768 pixels? No problem. The program for that is on the CD-ROM. Running OS/2? No problem. Here's the code for that. Nothing clever. Nothing written to save space. Just a lot of brute-force code. The fallout: greater reliability. In fact, Hummel believes the days of the clever, prima-donna programmer are numbered. Personally, I'm amazed at how easy it is to create a quality program with very little conventional programming skill using Visual Basic. And you'd have a difficult time filling an entire CD-ROM with the most bloated code imaginable.

When we go to blue lasers, things get even more interesting as the capacity (and data rate) of the drives quadruples. If a two-sided disk is ever standardized, it would mean more than 5 gigabytes of storage on one CD-ROM. What's the point of writing elegant code when there's no reason for it?

More Usable

Bill Gross of Knowledge Adventure is one of the most clever coders in the business. He once wrote a piece of code to compress images, allowing you to copy full-motion video to floppy disks. But CD-ROM makes his innovation virtually moot. Many Knowledge Adventure programs are now shipped on CD-ROM because customers demand it.

From a user's standpoint, CD-ROM is a much more convenient storage medium. Installation doesn't require disk swapping, and you avoid the constant risk of damaged disks.

Finally, consider the economics. With CD-ROM you can deliver software cheaper—and that's going to make the world question current software pricing. I notice that Sega has priced its CD-ROM games about the same as its cartridge games. But the cost of a cartridge is driven up by the fixed hardware expense. A complicated game takes a lot of memory—a large ROM built into the cartridge. So it makes sense that a game cartridge with many megabytes will cost a lot. But a CD-ROM costs a dollar to stamp out no matter how much code it contains. How can Sega sell the CD-ROM for the same price as the cartridge, when it may cost a tenth as much to make? It can't for long.

The potential to sell a CD-ROM with more than 600MB of data for $10 or less will eventually force software prices down. The public wants more and more for its money. This is especially true of the new software buyer—the bloke who never used a computer before but bought a cheap Windows machine because "it's supposed to be easy to use." People getting on the computer bandwagon this late in the game won't spend $400 for a word processing application when the entire system cost $1,200.

The opportunity to use CD-ROM technology to capture this market is obvious. One disk with everything you need. Twenty bucks. ◪

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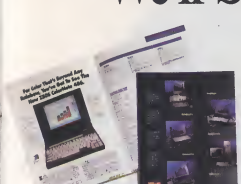

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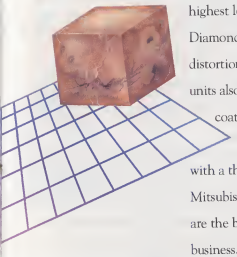

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Be Careful What You Don't Want—You Might Fail to Get It

THE ICE HAS BARELY BEGUN TO THINK ABOUT THE POSSIBILITY of melting. The only birds I can hear from my office, 40 floors up, are the ones I could produce by giving my head a swift, smart smack on the side of my credenza. It's deep winter. Nothing's going on. And, for the first time in living memory, I don't want anything.

It's a sickness of the spirit, this not-wanting. I wish there were something I could do about it. But I've tried. I paged through several back issues of this journal, trying to produce the customary rivulet of spittle associated with investigations of enormous SCSI hard drives daisy-chained with 1,200-dpi video broasters . . . nothing. Not a spark. Even when my 486/66 took a dog's age (like, eight seconds) to load our company logo into PhotoStyler, I didn't even spend a couple of bad minutes yearning for the Pentium I never had. I'm empty. It's a weird feeling. A failure of imagination.

Yes, that's it. My ability to dream up fantastic uses for the most outlandish objects has abandoned me, that's the problem. Ah, for the onrush of crushing desire I felt back at Comdex time! The world was bright then, full of hope and promise and the tang of a million unforeseen possibilities! Yet each option, when confronted, evaporated, simply because, stupid me. . . I couldn't think of a thing to do with the gizmolds involved.

It's Not Their Fault. It's Me

I never thought I'd say it, but. . . I seem to be satisfied with what I have. Isn't that obscene? And, in a deeper sense, crazy?

What of NEC's pen-based notebook with an active color-matrix display that offered itself so beguilingly at Vegas just a few short months ago? I'm not saying it wasn't beautiful but, hey, I still like my plain old Compaq 386 portable just fine. After all, all I do is write on it! I'm not a guy from Airborne Express registering a pickup with my handy little electronic pen. . . and if I want to draw, why not just go upstairs to my 6-by-9-inch Wacom tablet? It works just about as well as a man could want. Of course, if I woke up one morning to find the NEC wedged under my pillow, I wouldn't kick it out of bed. But yearn for it? Dream of it the way I used to hanker for a new Adobe font family? No.

Ah, for the onrush of crushing desire I felt back at Comdex time!

And what of my romance with fonts? Don't I want more? Wasn't there a time when I didn't meet a font I didn't hanker for to my very depths? But residing right here at my right hand are two CD-ROM discs, one full of delicious URW fonts that are completely accessible and totally uncoded, another with all the Adobe typefaces a human being could consider, all for the price of my corporate budget. Worse, somewhere in the back of a drawer I have more than 2,000 fonts from Tiger Software I never even cracked. Now that there are so many of them, available so cheaply, the whole concept seems somewhat devalued. But oh, there was a time when I had 650 fonts on my system! It took more than 5 minutes to boot into Windows! Now, I've come face to face with the horrible insight that I can actually make do with Adobe Caslon, Goudy, Garamond, Gill Sans, Helvetica Bold (the chairman's favorite), Peignot Demi, and Zapf Calligraphic. All the rest are nice, you know . . . but essential? No.

My CD-ROM drive, what of that? It's only a double-speed, it's true. Don't I ache for a NEC quad-speed to run. . . what. . . *Encarta? Hell Cab? Just Grandma and Me?* What CD-ROM software do I even need, anyhow? Maybe it's the passive, generally inert quality of the medium. So. . . do I want a Kodak Photo CD? Or better still, a writable CD-ROM from Sony that would enable me to back up my entire system—all 650 megs of charts, graphs, documents, and compressed videos—in 6½ minutes onto one glistening, micron-thin disc? Sure, I'd like one. Who wouldn't? But kill for one, like I really should? No. Why?!

This Has Got to Stop

I'm unrecognizable to myself. Wouldn't I fall down frothing at the ears for just a touch of the new DEC Alpha machine, running at, now get this, 320MHz?! Albert Einstein said that at speeds like that, time moves backward! What's the matter with me? How can I sleep at night, not having it?

More to the point, don't I want to introduce my company to the $6,000 video conferencing system from Acer, which includes one of its snappy 486s, a camera, and all of the necessary software to link my company into its own transcontinental belly button and back again? Well, why not?

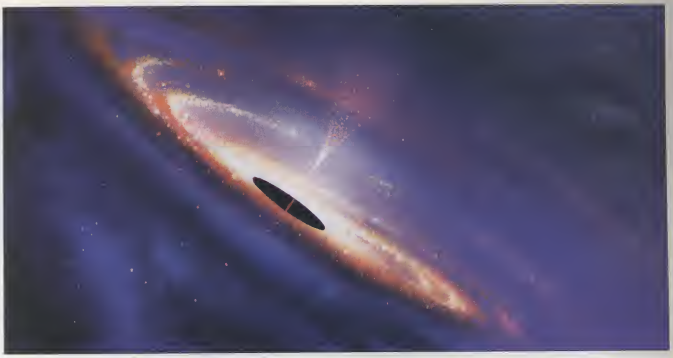
What about Apple's new Houdini, a prototype 486 system that enables a serious biplatform dude to shift from System 7 to Windows and back again with impunity? Wouldn't that be a gas? Finally, to be able to wear my crew cut and ponytail at the same time with no fear of paralyzing incompatibility? Isn't that something that makes me go all warm and tingly inside? How could it fail? And yet. . .

I Need a Lever, That's What

I need a lever into the engine of my desire, something to move the mechanism just enough, make it roll over and spark into life again.

Could it be an Intel wireless modem, so I can send

PHOTOGRAPHS: JONATHAN LEONE



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communications from any beach, airstrip, or Embassy Suite in the world?

No. Who wants to be so darn reachable?

Is it voice recognition software from IBM, which takes dictation and has a 20,000-word vocabulary?

I don't know. Maybe. Although if I wanted to talk to a machine, I probably would go to McDonald's and speak to the talking post at the drive-through window.

Is it Hewlett-Packard's new Fax tablet pad, which lets me send faxes to other Fax tablet pads?

Feh! Feh on faxes in general, anyhow!

Enough! Too much!

Perhaps I should attempt to work my way through this crisis, to get my mind off this terrible emptiness that now threatens to shorten my life as a maniacal wonk, and hurl me back into a normalcy I never sought.

Perhaps I'll just update some data I'm keeping on the wide variety of projects that are now menacing my professional existence.

Did I tell you I have this cute new personal information manager? It's called Info Select, from Micro Logic Corporation.

I've kind of gotten into their loopy little program lately, which is remarkable, when you come to think about it, since the entire concept of PIMs left me steaming cold from the outset. Who needs to register scraps of data, ideas, notions, in a logical, organized hierarchy? I don't. Never did.

Info Select is different, though. It's a lot closer to a stack of Post-It notes you hurl onto your desk because you know they're all current and you'll probably want to get to them sometime. It's useful. In fact, it's more than useful, it's a compelling reason to abandon your normal way of collecting and losing all of the slips, scraps, and orts of information that make up the interior of your brain pan on a normal working day. Info Select actually replicates the sprawling, disassociated, random quality of the semicreative, semicomatose human brain. And, without getting in your way by imposing some Teutonic and unnecessary structure, it lofts what you're thinking about into a digestible and compelling idea/fact buffet.

It's great. In fact. . . I love it. I'm using it a little bit more every day and enjoying it more each time I use it.

I'd forgotten how much fun it was to discover a brand-new program, get it cooking, and find out it really changes the way you do things. Come to think of it, there must be a ton of new hardware and software out there that's been cooked up in the two weeks since I really and truly wanted anything seriously. Yeah!

Where've I been? I'd better get going!

Hey—I'm back! ◪

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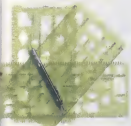

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SNEAK PREVIEW!

Inside WINDOWS

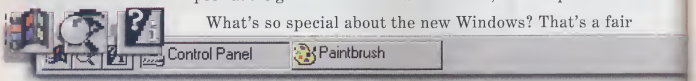
The most promising operating system in years is headed straight for your PC. Here's what you need to know now.

IT'S A SURE THING, a done deal: Come next year, you'll switch operating systems. And we know which one you'll switch to. Call it Chicago, call it Windows 4.0—or just call it the most eagerly awaited piece of software since . . . well, since Windows 3.0. Microsoft plans to make the next version of Windows the operating system on every PC in the known universe. After a sneak peek at the guts of the new 32-bit Windows, we're impressed.

What's so special about the new Windows? That's a fair question. After all, the flourish of trumpets that accompanies a major new operating system isn't new to your ears. Consider the fanfare you've heard in the past:

Apple caught up with you at halftime during the Super Bowl back in 1984. "Try our Macintosh," the company said. "It's graphical." But you didn't bite.

"Here," said IBM and Microsoft in 1988, trying to speak



BETTER BUTTONS
The new Windows parks on easy-to-navigate, dashboard-like control center at the bottom of your display. (It may look different in the finished product.) The icons don't get in your way at the bottom of the screen, and they come in handy for automating common tasks.

BY ED BOTT

4.0

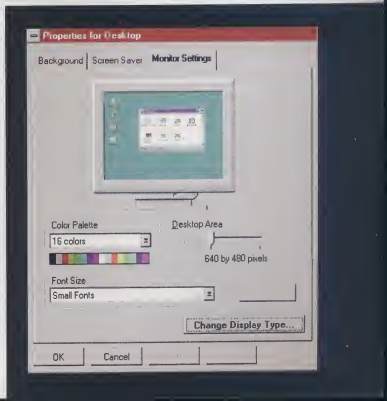
NETWORK SMARTS
What's the globe for? Click on it to get a host of improved networking features. Built-in messaging and much smoother network file access are some of the improvements to look for.

in unison and failing miserably. "This is OS/2. It multitasks." You just said no.

Then Apple came back in 1991 with System 7 for the Mac. "Look—it's graphical and it multitasks." But you were busy installing Windows 3.0 on top of DOS. IBM returned in 1992, with an all-new OS/2. "This is much better," it said. "It's graphical, it multitasks, it runs Windows apps, and it's 32 bits." You nodded approvingly and joined millions of PC users running DOS and Windows 3.1.

Slick 32-bit operating systems with graphical interfaces are nothing new. You've resisted them all, but that's about to change.

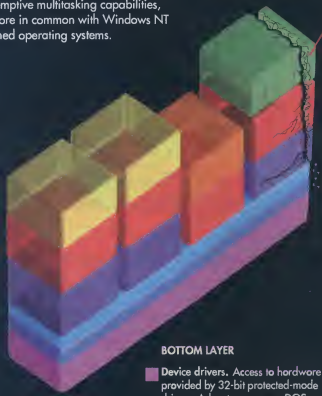
We've taken a careful look under the hood of your next operating system. Just look at what's in store for you. . . .



POINT-AND-SHOOT CONFIGURATION
From easy-to-adjust toggles to palettes, configuration options will be much easier to work with in Windows 4.0. Instead of a stripped-down Control Panel, you'll navigate helpful WYSIWYG dialog boxes like this one.

THE WINDOWS 4.0 ARCHITECTURE

So long, DOS, nice knowin' ya. With its 32-bit memory model and fully preemptive multitasking capabilities, Windows 4.0 has more in common with Windows NT than with old-fashioned operating systems.



CRASH!
One rogue program can't crash other running applications.

TOP LAYERS

- **16-bit Windows applications.** These share a single virtual machine, just as they do in Windows NT 3.1. You'll have to upgrade applications to gain multitasking and crash protection.
- **32-bit Windows applications.** These get memory protection and multitasking. Most 32-bit applications will run unmodified (but more slowly) under Windows 3.1, too.
- **DOS applications.** These get their own virtual machines, just as they do in OS/2 2.1.
- **Virtual machines.** These protect apps from crashing when other apps crash.

MIDDLE LAYERS

- **Subsystems.** From the user interface to the network, 32-bit modules handle the grunt work of running a PC.
- **File system.** Windows 4.0 (and DOS 7) will add extensions to the file allocation table to permit long filenames and file attributes.
- **Memory and Process Manager.** As in Windows NT, each 32-bit application gets its own protected memory space and preemptive multitasking.

BOTTOM LAYER

- **Device drivers.** Access to hardware is provided by 32-bit protected-mode drivers. Advantages over a DOS system include Plug and Play setup, faster performance, and fewer crashes.

It's code-named the Chicago Project. It has probably taken as many person-years as World War II's Manhattan Project, and it has been shrouded in nearly as much secrecy. Here's what's behind the veil.

Chicago uses all-new code, written from the ground up. Like OS/2 2.1 and Windows NT 3.1, it's a 32-bit, protected-mode, preemptively multitasking operating system. Parts of the Chicago technology will probably appear in a slim box labeled DOS 7 that will allow DOS diehards to work in character mode for a few extra years. The rest of it—all the good stuff—is destined to go in Windows 4.0. (See the Windows architecture illustration above.)

If this were *Jeopardy*, the answer would be, "What do you get when you morph DOS, Windows, and Windows for Workgroups?" Whereas Windows 3.0 put a friendly face on DOS, Chicago gives it a technological overhaul.

It's designed to be absolutely compatible with the installed base of Windows 3.1 machines—assuming they're powered by a 386 or 486 CPU. In the Chicago era, the 286 will be officially, indisputably, undeniably dead.

Down at the bedrock layer, it's stuffed with 32-bit code that runs in protected mode. You could think of Chicago as Windows NT Lite, but it won't replace Windows NT, which will continue to evolve for workstation-class applications and network servers. In the Windows pecking order, NT will be the technologically upscale operating system, with higher performance, wide-area networking, and enough whizzy security features to fill a Tom Clancy novel. Windows 4.0 will be the network client that also does peer-to-peer sharing. At Microsoft, the Advanced Systems Group handles Windows NT, while the Personal Systems Group works on Chicago. 'Nuff said.

When you take Chicago apart, you discover that few of its building blocks are new. There's an impressive new Plug and Play standard to take the pain out of hardware configuration (see the three Plug and Play payoff illustrations on pages 133, 134, and 135). Thanks to full 32-bit application program interfaces (APIs), the next generation of Windows software should be more snappy. OLE 2.0—*PC/Computing*'s 1993 MVP Award–winning OLE technology—takes one more great leap forward. Oh, and there's a new interface.

What's Inside Windows 4.0?

From built-in messaging to long filenames, Windows will get smarter.

	How You Work Today	How Windows 4.0 Will Work	Who Sets the Standard
Application integration	Cut, copy, and paste. OLE 2.0, with in-place editing and the ability to control one application from another, is just beginning to appear in mainstream business software.	Windows 4.0 will build OLE 2.0 support into the shell, making it easier to drag and drop text and icons between applications. But the object-oriented promised land is still off in the distance.	In the race to tie applications together, the starting gate hasn't even opened yet. Apple's OpenDoc and IBM's System Object Model have potential, but most developers are placing their bets on OLE 2.0.
Application support	You probably have immediate family members who are developing Windows applications. The Mac has lost its lead as the hat hangout for graphical application developers.	Every software firm with a Windows application is working to make the next version compatible with Windows 4.0. Microsoft's secret: the Win32 API, allowing the same program to run under Windows 4.0, NT, and even 3.1.	It's not even close. Windows is where software developers go to make serious money.
File management	Eight characters for the filename, three for the extension. Under DOS and Windows, filenames are sometimes creative, but usually just cryptic.	Long filenames are the most obvious change, but look for additional file attributes such as size and format details. Underneath it all, though, Windows 4.0 will still manipulate eight-character filenames.	The Mac's files and folders are the easiest to use. OS/2 2.1, despite a few rough spots, has the most sophisticated approach to tracking files and file attributes.
Hardware configuration	Set a jumper. Load a driver. Add a command-line switch. Reboot. Tinker until it works. Repeat the process every time you add a new device. Hardware support is the curse of the PC platform.	Eventually, the Plug and Play standard should eliminate all but the peskiest hardware hassles. Windows 4.0 supports Plug and Play; PCs and peripherals with Plug and Play features will arrive by the truckload later this year.	For just-do-it hardware support, na one can touch Apple's Macintosh today. Hard-care Unix supporters can make a lukewarm case for the OpenBoot feature in Sun Microsystems' Solaris operating system.
Multitasking and multithreading	Windows 3.1 handles basic multitasking OK. Complicated tasks like high-speed communications or full-motion video, though, are digital quicksand traps.	Windows 4.0 will do preemptive multitasking, just like OS/2 2.1 and Windows NT 3.1. Individual applications will be able to split into multiple threads for better performance.	OS/2 2.1, Windows NT 3.1, and any version of Unix can run rings around DOS, Windows 3.1, and Mac's System 7.
Networking and communications	Windows 3.1 is a nightmare for network administrators. Windows for Workgroups 3.11, with 32-bit NetWare drivers and rock-solid NT connections, is a dream client.	Windows 4.0 will offer all of the networking support of Windows for Workgroups 3.11, plus advanced communication features, including built-in mail and messaging services.	Windows NT 3.1 has potential, but Unix is the Internet. If you can master the interface, you can go anywhere with a Unix system.

For now, we'll call it Windows 4.0. If Microsoft adheres to its shipping schedules, this new operating system will hit your desktop before year's end. At this early stage, it's not really a product yet—it's a collection of design specifications, APIs, and usability experiments. It's too early to provide an in-depth critique of the next version of Windows, but we can give you a close-up look at the technology inside it. Mark our words: It will change the way you think about computing.

Plug and Play

You can kiss hardware conflicts and configuration quagmires good-bye.

Every PC user knows that dealing with hardware is a recurring nightmare. Jumpers and dip switches, IRQs, base addresses, DMA channels, and device drivers are the demons that torment us by day and keep us awake at night. Downtime caused by hardware conflicts is the price we pay for the anything-goes PC clone market and the who-cares-about-hardware heritage of MS-DOS. And users aren't the only ones who pay: Microsoft figures that nearly half of the calls to its Windows support lines are hardware-related.

Short of scrapping every IBM-compatible PC and starting over, the answer is an industrywide hardware standard—led by Microsoft, Intel, Compaq, and Phoenix Technologies—called Plug and Play. Windows 4.0 will be the first operating system to support the Plug and Play specification. It won't happen overnight, but the combination of Plug and Play hardware and Windows 4.0 will ultimately relieve us humans of the dirty business of configuring PCs.

Think of it as a Wizard that does hardware: The Plug and Play spec is a comprehensive agreement on how to build a system that can literally configure itself. In theory, Plug and Play does for the PC platform what Macintosh users have taken for granted since day one. It's not just an upgrade issue, either. Plug and Play has enormous potential for mobile computing and wireless communications as well.

For Plug and Play to work, you need both hardware and software. The hardware side includes a Plug and Play BIOS that can sense the presence or absence of system components such as a disk controller or a keyboard at startup. The Plug and Play BIOS also has to stay on the lookout for dynamic configuration changes (such as a PCMCIA card being inserted into a socket) and send messages to the operating system when significant configuration changes occur.

In a Plug and Play system, add-in hardware must be able to identify itself on demand. That's easy for EISA and Micro Channel cards, which already include ID

NONSTOP TO CHICAGO, ON TO CAIRO

Five years of Windows.

Great operating systems don't happen overnight. Windows 4.0 is a culmination of years of work, and its parts are culled from many products. From Norton Desktop to Windows NT, Windows has gathered influences since it took off in 1990.

May 1990–June 1991
DOS 5 and Windows 3.0 arrive. The last great DOS and the first great Windows signal the changing of the guard in PC operating systems.

March 1992
OS/2 2.0 ships. IBM wins awards for 32-bit technology and its innovative interface, but Windows keeps setting sales records.

July 1991
Norton Desktop for Windows is the first successful attempt to improve the Windows interface

April 1992
Windows 3.1 fixes bugs and fine-tunes performance. By year's end, it's nearly impossible to buy a PC without Windows.

March 1993
The Software Publishers Association reports that Windows applications outsell DOS programs for the first time.

codes. A manufacturer ID string is part of the PCMCIA standard, too. But the enormous installed base of ISA devices—from fax modems to sound cards to network adapters—is not ready for Plug and Play's prime time. The actual cost of the hardware changes is trivial, but a complete Plug and Play system will require a whole new generation of peripherals and device drivers.

And then there's the operating system. Windows 4.0 has to keep track of this flood of information and translate it into on-the-fly configuration changes that keep the PC up and running. To accomplish this task smoothly, the operating system will include four new components.

Under Windows 4.0, the *Configuration Manager* is Plug and Play Mission Control. This essential system service feature handles all of the configuration spadework when it receives the initial startup device list from the BIOS and when the BIOS sends word of a dynamic configuration change. The Configuration Manager loads and unloads drivers, allocates resources (IRQs and DMA channels, for example), and in cases of conflicts, tries different configurations until it finds one that works.

It also coordinates communications between other parts of the system, including applications. Those communications add a new level of protection: For example, the Configuration Manager might ask a Plug and Play–aware application if it wants to save files on a removable hard drive before allowing the system to eject that drive.

Quick, tell us everything about your current hardware. Could you do it? Probably not, but Windows will soon come to the rescue. Windows 4.0's *Hardware Tree* contains a detailed record of the current system configuration. Stored in RAM, the Hardware Tree includes every scrap of information required to properly configure a piece of hardware, including I/O ports, IRQs, required drivers, and user preferences. It's built on the fly from a central database that's updated every time you add a new device or change the settings of an existing one. Because this central database is open to applications and device drivers, it should eliminate the need for most INI files and command-line switches.

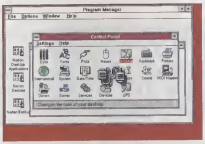
Bus enumerators are special drivers that understand the ins and outs of different PC bus types—SCSI, EISA, PCMCIA, and so on. The job of each bus enumerator is to identify the devices on its bus, read their resource requirements, and follow the Configuration Manager's instructions to set them up. The critical function of the bus enumerator is to retrieve configuration information for each device on its bus, and assign a unique identification code to each one.

Broadly speaking, an operating system is a systemwide decision maker. Wouldn't you like your operating system to make the best decisions when it comes to configuration?

April 1993
The OLE 2.0 specification is released. Applications are slow to arrive, but this is the foundation for the next generation of Windows.

April 1993
Microsoft and Intel release Version 0.9 of the Plug and Play specification. The first Plug and Play products appear within months.

May 1993
OS/2 2.1 adds Windows 3.1 support and great multimedia. It briefly hits the top of the best-seller lists.



July 1993
Windows NT 3.1 arrives. Microsoft positions it as a powerful network operating system. Windows 3.1 continues to set sales records.

October 1993
Windows for Workgroups 3.11 ships quietly. It includes Chicago and Microsoft At Work technologies.

Late 1994*
Windows 4.0 (code-named Chicago) is scheduled to ship. Unlike earlier 32-bit operating systems, users should expect a flood of compatible applications almost immediately.

Mid-1995*
Object-oriented Windows NT (code-named Cairo) is scheduled to arrive.

*Projected dates.

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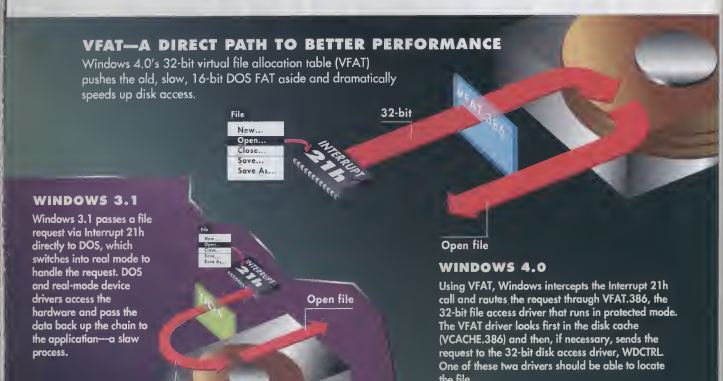


That's where the *Resource Arbitrator* comes in. It's a system service that works with the Configuration Manager to allocate specific resources to each device, and to deal with conflicts—when two devices try to grab the same IRQ, for example. Unlike DOS, which usually requires you to reboot to change an IRQ setting or free memory used by a device driver, Windows 4.0's Resource Arbitrator releases or reassigns resources on the fly.

Plug and Play offers an instant usability payoff. With a SCSI device like a CD-ROM drive, Plug and Play can take care of messy details like setting a unique ID and terminating the last device in the chain. PCMCIA devices should be much easier to use when Plug and Play drivers allow "hot swapping" without restarting the system.

In a Plug and Play world, docking stations will finally make sense. Snug in a VCR-style docking station, a subnotebook can drive an oversized monitor at high resolution, make a network connection, and let you use a full-sized keyboard and mouse. Push the eject button, and the Plug and Play subsystem will switch to the proper drivers for the built-in display, keyboard, and pointing device, as well as politely prompt you to save any open files on the server, gracefully log you off the network, and kick in your subnotebook's power-saving circuits. And you don't have to reboot or fiddle with startup files.

Wireless technology gets a Plug and Play boost, too. When a notebook equipped with a wireless network adapter or printer connection comes within range of an infrared or radio node, the Plug and Play BIOS detects the new configuration and immediately makes it available.

The first Plug and Play products are already here. Future Domain introduced a Plug and Play SCSI controller and Intel came out with a Plug and Play audio card late last year. So how does a Plug and Play peripheral work under Windows 3.1? No differently than a conventional ISA card; Plug and Play doesn't change the ISA spec at all. And how will Windows 4.0 handle older ISA add-ins? By doing some, but not all, of the work. You may have to look up information in manuals and mess with jumper settings, but a configuration utility will capture your input and store it in the configuration database.

Familiar but New Interface

Will the new Windows look like the old Windows? You bet—with some new usability enhancements.

There's a handful of Microsoft employees who are probably fit enough to run back-to-back marathons by now. They're the messengers who have been carrying test results from Microsoft's usability labs to the developers who have been pounding out code in the Chicago Project programming labs.

For Windows 4.0 to succeed, Microsoft must pull off a delicate balancing act between usability and compatibility.

The entire Windows interface is due for an overhaul aimed directly at first-time PC buyers. At the same time, the interface has to look, feel, and act enough like Windows 3.1 to keep millions of upgraders happy and productive. So it's no surprise that Windows 4.0 is getting a round-the-clock workout in the usability lab. Over the next nine months, the new Windows interface will continue to evolve, especially as usability testers focus on the nuts and bolts of the new interface. Cosmetic details may change, but the foundation of the new interface is well established and the design goals are clear.

We looked at preliminary versions of the Chicago software developers kit, the so-called milestone releases distributed to developers to help them build and test new 32-bit Windows applications. In these early releases (code-named M4 and M5), the new Windows interface looks remarkably like OS/2's Workplace Shell. Whereas Windows 3.1 offers a confusing mishmash of icons, program groups, lists, and menus, Windows 4.0 will follow OS/2's lead and treat every file as an object with properties that can change depending on the function.

Every file has an icon. Icons sit inside folders. You can have folders within folders. In fact, the Desktop is just another folder. If you can grasp those basic concepts, you understand the Windows interface. It should be an easy migration for Mac and OS/2 users, who mastered these fundamentals years ago.

Look for Windows 4.0 to slice away whole layers of middle management. Program Manager and File Manager, for example, are certain to get pink slips. Windows and dialog boxes will get a new 3-D look. Windows has always needed a trash can—Windows 4.0 will fill the need with a politically correct recycling bin. A system toolbar along the bottom of the screen will let you switch between tasks without having to call up a Task Manager or pull down a control menu.

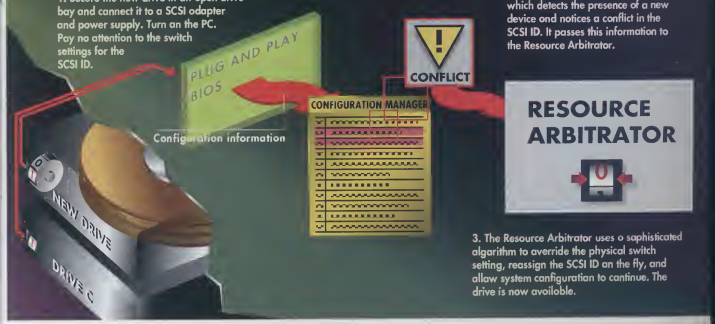
Simplify. That's what usability testing teaches developers, and the principle will be apparent in the Windows 4.0 interface. No matter where you are, a set of common actions should be available. Right-mouse click on any object to pop up menus and tabbed property sheets much like those in OS/2. More actions will be one click away: Usability testing says most people don't understand the difference between double-clicking and single-clicking.

There will probably be built-in pen support, which opens interesting possibilities for new input devices. File Manager's successor will climb a few rungs up the evolutionary ladder and concentrate more on finding files than on simply listing them. And you'll be able to drag just about anything just about anywhere.

Long filenames—up to 255 characters—are the most obvious (and welcome) change in the Windows 4.0 file system, but there are more surprises in store. Extra file attributes—an author's name, summary, key

Plug and Play Payoff #1: EASIER UPGRADES

With a smarter operating system and cooperative peripherals, upgrading a PC should become painless. Want to add a new SCSI drive? No problem.



words, and so on—are stored directly with the file. Applications can search for files using this additional information. It's a short hop from the Windows 4.0 file system to Cairo's (Windows NT's) fully object-oriented file system.

Application Integration

Why shouldn't your operating system join forces with your apps instead of fighting them?

For more than a decade, PC users have been conditioned to think in terms of applications. When you want to write a report, you use a word processor. To produce a quarterly profit-and-loss statement, you use a spreadsheet. Want to send a memo to Turner in MIS? Double-click on the e-mail program icon.

In a world filled with rich data types—not just words and numbers, but graphics, sound, and even full-motion video—this application-centric view of the world feels like something cobbled together by the Windows enclave of the Flat Earth Society. The more natural working environment is one in which applications are simply tools on a desktop. Need to work with numbers? Grab the number-crunching tool. Need to say a few words to introduce a report? Drop a sound object onto the desktop and talk into the microphone.

It's called a document-centric architecture, and if you've used visual editing in an OLE 2.0 application, you've had a brief glimpse of it. Cairo, the next major release of Windows NT, is the object-oriented promised land, where the file system itself will track every aspect of your computing work. In between the two, there's Windows 4.0.

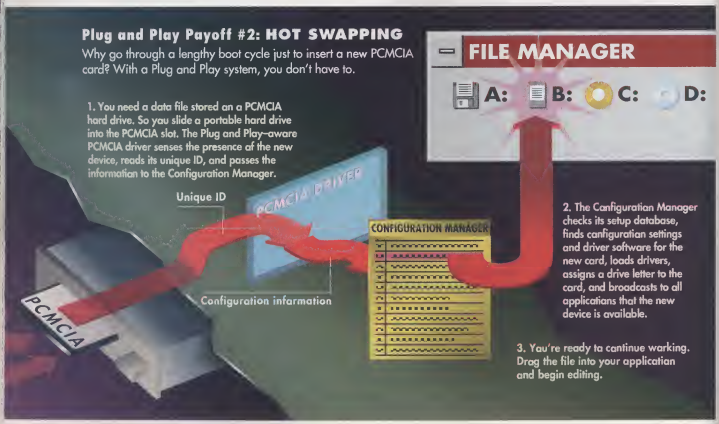
Object linking and embedding is everywhere in Windows 4.0. In fact, the new Windows desktop itself will be an OLE-aware application, not just a flat surface to hold up Windows wallpaper. With object-oriented services built into the operating system, you might be able to drag text directly from a document into a dialog box. With OLE 2.0's ability to automate applications, you might install a new application by dragging an Update icon from one folder to another.

In theory, at least, it should be possible to combine two well-constructed Windows 4.0 programs into a new application that combines the best features of both. In practice, it's likely this capability will be used first by corporate and commercial developers in conjunction with visual programming tools such as C++ and Visual Basic.

Multitasking, Multithreading, Multimedia

Multiple applications? Resource-intensive multimedia apps? They'll all purr under your new operating system.

Can Windows 4.0 handle multiple applications? Better than Windows 3.1, presumably, but probably short of the



resource-intensive Windows NT (see the Windows 4.0 architecture illustration on page 126). Unlike Windows 3.1, which uses cooperative multitasking, or *time slicing*, to switch between running programs, Windows 4.0 will support preemptive multitasking, in which applications that need extra processing power can claim a bigger share of the CPU. That should make for smoother background communications. It should also give multimedia performance a healthy kick. Even without competition from other applications, multimedia applications should run more smoothly under Windows 4.0, thanks to rewritten 32-bit multimedia subsystems.

There will still be thousands of DOS and Windows 3.1 apps out there. Will Windows 4.0 run them all? There's no reason it shouldn't. In fact, DOS applications may run better under Windows 4.0 than under any version of MS-DOS. That's because, just like OS/2 2.1, Windows 4.0 can "tune" the properties of a DOS virtual machine. And because there are no more real-mode DOS device drivers of any sort, expect to see humongous virtual DOS machines with 630K or more of free memory.

As for 16-bit Windows applications, they should run without problems under Windows 4.0—but don't expect performance gains or crash protection. That's because Windows 4.0 inherits one of Windows NT's least desirable design features: a single virtual machine shared by all 16-bit Windows programs. DOS and 32-bit Windows applications get their own protected spaces in memory; if one crashes, the rest run safely. But when a 16-bit Windows application freezes, you risk losing all the data in other active 16-bit Windows programs. The first wave of 32-bit applications should crest about the time Windows 4.0 appears, just in time to keep such potential disasters from being a major stumbling block to upgraders.

Networking and Communications

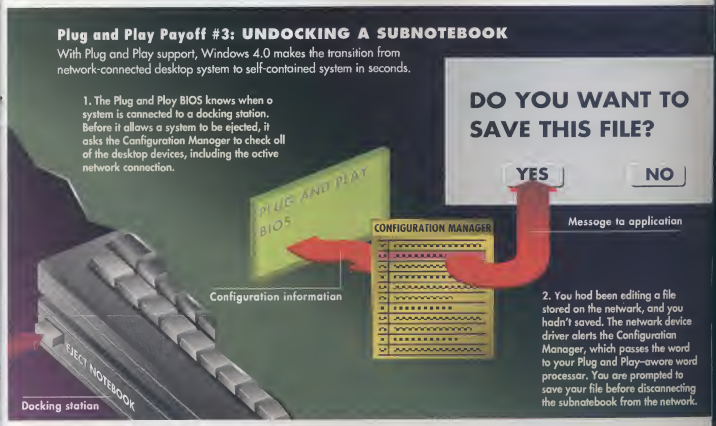
Built-in messaging, smooth network file access, and fax smarts within any app.

If the different development teams at Microsoft are talking with one another, Windows 4.0 should be the dream client on a Windows NT network. Microsoft has dropped hints that this version of Windows will be chock-full of advanced communication features, including built-in mail and messaging services. Windows for Workgroups 3.11 already includes a fax engine designed to the Microsoft At Work standard. Look for more examples of Microsoft At Work technology in Windows 4.0.

If you haven't tuned in to the news on Microsoft At Work, it's basically universal fax intelligence built right into the operating system. Why jump into a dedicated fax software product when your operating system can make faxing automatic, no matter what application you're in? Want to fax a Word document from Word? No problem.

Plug and Play Payoff #3: UNDOCKING A SUBNOTEBOOK

With Plug and Play support, Windows 4.0 makes the transition from network-connected desktop system to self-contained system in seconds.



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NEC

Circle 157 on reader service card.

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Our philosophy is that a notebook PC shouldn't be some frozen, soldered-together lump of metal and plastic, easily superseded by the next advance in technology. It should be upgradable and expandable, ready to embrace new technologies that come along.

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Starting out, of course, we've made Versa as powerful and as useful as technology permits. In fact, our new Versa is even more capable than the Versa that PC Magazine called "Best of 1993."*

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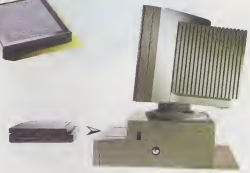
Versa's screen—crisp, sharp monochrome or brighter-than-ever active-matrix color—can be reversed for presentations.

Our exclusive DoubleTime™ technology lets you snap in a second battery in place of the removable floppy drive, giving you up to 10 hours of computing time.



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BYTE

MVP PERIODICAL

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intel inside

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NetWare client support is already available in Windows for Workgroups in the form of protected-mode, virtual device drivers. And peer-to-peer networking in the form of directory sharing has been a part of Windows for Workgroups since its inception. Both of these features should migrate to Windows 4.0. Nevertheless, don't expect Windows 4.0 to add any of the network administration and security options that you find in Windows NT.

Remote access—another Windows for Workgroups feature—will probably get better in this release, thanks to the more robust 32-bit communications drivers.

Probably the best news for network clients is the feature that won't survive the upgrade process. Sources say network file access under Windows 4.0 won't require drive mappings. As in Windows NT, servers—whether they're peers or NT Advanced Servers—simply show up as named icons in the new file explorer.

Application Support

Applications usher in a new operating system and they're all hailing the new Windows.

Who's developing for Windows 4.0? Everybody. On- and off-the-record comments by the who's who among leading application developers suggest that Microsoft has loads of support for the next version of Windows. You can bet that Microsoft will have a Windows 4.0 version of its Office suite ready within weeks of the new operating system's release. Sources at Lotus confirm that they're actively working on 32-bit versions of every SmartSuite application as well.

And they're not alone. Microsoft's week-long Professional Developer's Conference last December drew standing-room-only crowds—more than 6,500 paid attendees in all—to learn about Microsoft's systems strategy and get a copy of the Chicago software developers kit.

Why will this new 32-bit operating system succeed in immediately attracting widespread application support? After all, OS/2 2.1 has struggled for nearly two years to earn the respect of developers.

It's partly because Windows 4.0 is a safe bet. Build an application using Microsoft's Win32 APIs, and it will run unmodified on Windows 4.0 and Windows NT machines. Distribute the 32-bit Win32 dynamic link libraries, and even Windows 3.1 users can run a 32-bit application, although they might not have access to all its features.

Even more important, though, is Microsoft's determination to put this operating system on every desktop in the universe. DOS 5 was the biggest software hit of its era. Windows 3.1 continues to break sales records. Windows 4.0 is a replacement for both. So why shouldn't it be the biggest software hit of all time?

FINAL ANALYSIS YOUR NEXT OPERATING SYSTEM

Answers to your Windows questions.

Q: OS/2's still here, and it has at least a two-year head start on Windows 4.0. How will IBM deal with the challenges that Microsoft is presenting?

A: IBM's strategy is to support the mainstream version of Windows, so expect the company to offer support for 32-bit Windows applications shortly after Windows 4.0 ships. OLE 2.0 is already supported within individual Win-OS/2 sessions. And IBM pledges that OS/2 will support Plug and Play in its next shrink-wrapped release. IBM has done a first-rate job of maintaining OS/2's ability to run Windows applications. That trend will continue.

Q: Isn't there a chance that Windows 4.0 will be a real flop in spite of its technology?

A: You might as well put your money on Wile E. Coyote to finally catch the Roadrunner. Microsoft's secret weapon is its stack of contracts with just about every PC maker in the world. Thanks to those deals, you can be sure that Windows 4.0 will be preloaded on more than 70 percent of all PCs sold in 1995. Even the most conservative estimate pegs that number at more than 10 million systems. And look for Microsoft to do everything but sell the new Windows door to door in an effort to convince you to upgrade.

Q: When do I have to deal with the upgrade decision?

A: Maybe you won't have to decide. If your 1995 budget includes a line for PCs, you'll have to go out of your way *not* to upgrade. For the rest of us, it's the same old story: Applications drive operating systems. In the first half of 1995, you'll probably be faced with multiple upgrade decisions as application vendors flood the market with powerful new 32-bit Windows applications.

Q: What does this mean for DOS? Is DOS *finally* dead?

A: No doubt about it. Next year is the year the market finally pulls the plug on the MS-DOS life-support system. Not that its vital signs have been that reassuring the past few years, anyway. With the glaring exception of WordPerfect 6.0, it's nearly impossible to name a major DOS application that had a significant upgrade in 1993. DOS will survive on 286 machines, whose owners aren't likely to upgrade applications *or* operating systems.

PowerViewer

It's 9:00, Monday morning and you've just learned the horrifying news. That big meeting with the president of the company next week? It's been moved up. Way, way up. And that report for the big meeting? It's due in half an hour. Fortunately, you've got PowerViewer™ for Windows™, the one tool that lets you access virtually any database and create presentation-ready reports with a few simple clicks of the mouse. You take a long sip of coffee, sit down in front of your computer and click open PowerViewer.

Access More Information.

Click. Quickly, you access the Connect Profile menu and select the database you want. Because PowerViewer supports over 25 of the most popular PC and relational databases, all the information you need is right at your fingertips. And with Powersoft's Database Connection Hotline, you know any questions you have will receive immediate answers. Click. You go into the Report Painter and select the specific data for your report using one of PowerViewer's powerful point-and-click query techniques. You choose the one that suits you best, whether it's our easy-to-use QuickSelect, our powerful graphical query builder, or a query you've saved from a previous task. Click. Now you're ready to create your report. You select one of the many built-in QuickStyle

Create Stunning Reports.

templates that enable you to create stunning reports with full-color 2D and 3D graphs and charts. PowerGuides and Data Smart design tools lead you through every step and let you preview and customize any aspect of your report in seconds. Include a pie chart. Change fonts. Add colors. Pull in your corporate logo. And click, click, click — suddenly, you've created a masterpiece. PowerViewer makes information access as simple as point and click. It empowers you to make full use of your company's information and lets you do it faster and with greater ease than you ever thought possible.

PowerViewer, Just $99.*

It's 11:00 and you've just come out of the big meeting. Your report was a hit. A big hit. So big, in fact, the president has asked you to run it by the entire company, gather everyone's opinions and give him a report on your findings. Under ordinary circumstances, this would be the kind of news that could ruin your entire month. Fortunately, one of your colleagues has PowerMaker™ for Windows, the tool that gives you all the functionality of PowerViewer plus the power to design fully-interactive forms, manipulate databases and create complete Windows-based applications in no time.

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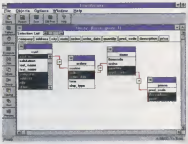

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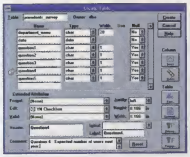

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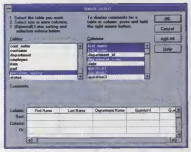

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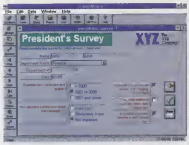

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Of course, this scenario is merely a reenactment of the typical office crisis. But the fact is, PowerViewer and PowerMaker make accessing the information you need, producing stunning reports, and even creating and distributing your own Windows applications as simple as point and click. And right now, these tools are not only incredibly easy to use. They're also incredibly easy to buy, because we're offering them to you at special prices of just $99 for PowerViewer and $199 for PowerMaker. And each is backed by Powersoft's 30-day satisfaction guarantee. To order PowerViewer and PowerMaker today, simply contact your corporate reseller, stop by CompUSA or call Powersoft directly at **1-800-273-2841.**

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Cutting-Edge

State-of-the-art à la carte: ultrafast CD-ROM drives, big monitors, hot new sound cards, and full-motion video.

Look at it. Listen to it. It's crying out for more. Even if your PC already sports a sound card and a CD-ROM drive, chances are it's nowhere near ready for today's sense-shattering multimedia applications—or for the multimedia future that looms ahead.

Just as herds of breathless multimedia pundits quieted down, a new, best-of-breed set of products exploded out of the gate. We're not talking about Mickey Mouse products. We're talking about multimedia as it was meant to be: rich sound, smooth-as-silk video—the whole nine yards. Computing just got a shot of adrenaline.

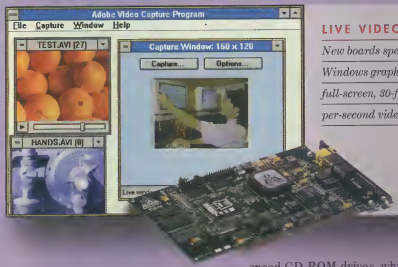
Big monitors and better video cards are becoming de rigueur. If you're stuck with a display smaller than 17 inches, you're slouching toward retrograde. We jury tested 20- and 21-inch displays, and the winners are a feast for the eyes.

Likewise for CD-ROM drives. If you're like most PC users, lowly floppy drives and hard drives are probably still your most frequently used media. Ouch. There *is* a better way. Even as more and more products—from Windows NT to CorelDraw—show up on CD-ROM, the bar for state-of-the-art CD-ROM drives gets ever-higher. Case in point: For this story, we tested a CD-ROM

MONITORS 144
The big picture: 20- and 21-inch displays bring multimedia to life.

PHOTOGRAPHY BY [illegible]

Multimedia



LIVE VIDEO 154

New boards speed Windows graphics and full-screen, 30-frame-per-second video.

jukebox that lets you cram in 18 CDs—and run them faster than ever. We also tested dual-, triple-, and quad-speed CD-ROM drives, which are fast enough to permanently cure you of the finger-drumming syndrome.

It's time to herald a new era in sound cards, too. From digital signal processors to wave-table synthesis to QSound Virtual Audio, a chorus of cutting-edge sound technologies is poised to overhaul your PC's pipes. We lent our ears to the best new sound cards for this story, and the results will surprise you.

The bottom line: *Multimedia* isn't just a buzzword anymore. In fact, the term is destined to go away altogether, because anything less than multimedia spells compromise. In the blink of an eye, innovative new products like the ones in this story will go from wish-list items to must-haves.

SOUND CARDS 152

DSPs and wave-table technology do away with wimpy beeps.

CD-ROM DRIVES 148

Quad-speed, triple-speed, and jukebox drives set a new CD standard.

Panoramic View

Get an eyeful with 20- and 21-inch displays. BY WENDY TAYLOR

Check out the monitor on your desk. Is it an anemic 14-inch box perched pathetically atop your PC? Do you have to squint to read 8-point type? That's no way to run multimedia—or Windows, for that matter. State-of-the-art 20- and 21-inch displays can give you a whole new outlook on the video, animation, and graphics that make multimedia so seductive. And to display multiple windows and applications in Windows simultaneously, big screens offer the ideal combination of high resolutions (1,280 by 1,024 pixels and higher) and generous screen real estate.

To find out how good the view gets, we looked for the most highly evolved 20- and 21-inch monitors we could find. Image quality is the top priority in displays this large, and the best monitors come with flat-square or Trinitron-style tubes to minimize glare and image distortion. A dot pitch of 0.31mm or smaller is also key to ensure the sharpest focus possible.

Displays this large make ultrahigh resolutions feasible, and the best 20- and 21-inch displays support at least 1,280 by 1,024 pixels at 76Hz refresh rates to ensure a flicker-free image. And some of the newest displays—such as the Nokia Multigraph 445X—go even further: 1,600 by 1,200 pixels.

Sophisticated controls to adjust image size, position, color, and other settings are also essential in monitors of these proportions. With this in mind, we jury-tested monitors that include advanced controls for everything from image size to color convergence. We also required that the monitors have microprocessor-based digital controls for saving custom image settings in memory. (See "How Digital Monitor Controls Work," below.)

Finally, construction and design are also vital features in anything you'll spend hours staring at, so we considered only monitors that met the Swedish MPR II low-emissions standard. They also had to support the EPA Energy Star standard, or some other type of power management, because displays this large account for as much as 80 percent of the total energy consumed by a system.

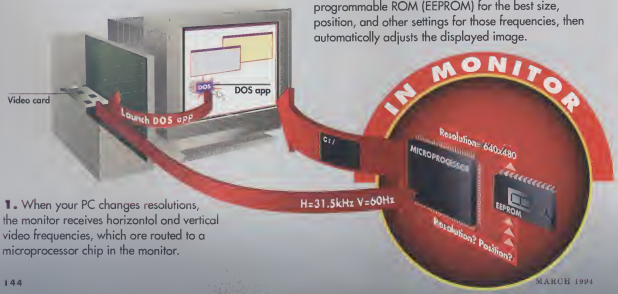
In the end, only ten displays met our criteria. Priced between $2,000 and $3,500, these two-page displays are hardly inexpensive. The favorite in our image tests was NEC's MultiSync 6FGp, followed closely by Nokia's Multigraph 445X. Honorable mentions go to the displays from IBM, Mitsubishi, and Nanao, which were also clear and bright. And for those of you on a budget, the 17-inch versions of any of these monitors will save you about $1,000, and they merit consideration. But if you want the best—look no further.

HOW DIGITAL MONITOR CONTROLS WORK

Better monitors allow you to save custom image settings.

Every video resolution has a different set of ideal image parameters. In high-end monitors with digital controls, a microprocessor chip allows you to select the best image settings for a particular resolution, then automatically save those settings in memory.

2. The microprocessor checks its electrically erasable programmable ROM (EEPROM) for the best size, position, and other settings for those frequencies, then automatically adjusts the displayed image.



1. When your PC changes resolutions, the monitor receives horizontal and vertical video frequencies, which are routed to a microprocessor chip in the monitor.

Which Display Is Right for You?

The clear favorite? NEC's MultiSync 6FGp.

	Image Quality	Pros and Cons	The Bottom Line
IBM 21P $2,249 (800) 426-2968 (914) 766-1900 Reader Service No. 680	Sharp image an its Trinitran tube, althaugh its calars aren't as bright and uniform as thase an NEC's MultiSync and Nakia's Multigraph.	Pras: The mast affardable Trinitran af the bunch. Cans: The wide bezel dwarfs the image—we wauldn't mind a sleeker design.	Unbeatable price. A capable 21-inch display at an inviting price. It uses the same well-crafted tube as Mitsubishi's Diamand Pra 21T, but casts $950 less. A great value.
Idek Iiyama North America VisionMaster 21 MF-8621 $2,995 (800) 394-4335 (215) 957-6543 Reader Service No. 681	Clear, unifarm whites, but the antiglare caating degrades focus. Calars are rich and true.	Pras: Extensive image cantrals; salidly built. Cans: Daesn't switch resalutians smoothly fram Windaws ta DOS.	Clear and capable. Bright calars, but facus cauld be better. We alsa wish it were less expensive.
Mag Innovision MX21F $2,499 (800) 827-3998 (714) 751-2008 Reader Service No. 682	Grainy images; calars and whites are murky.	Pras: LED readaut shaws active resalutian and refresh rate. Cans: Flimsy, detachable base is prane ta breaking.	Muddy color and focus. The antiglare caating cuts image quality as well as glare. It's campetent, but nat a shawstopper.
Mitsubishi Electronics America Diamond Pro 21T $3,199 (800) 843-2515 (714) 236-6352 Reader Service No. 683	An eye-pleaser in every respect. The Trinitran-style tube makes far rich calars and razar-sharp facus.	Pras: Solid, trim design. Cans: One af the mast expensive in its class. Alsa, the cantrals are samewhat cryptic.	Bright and beautiful. We lave the image, we'd like better cantrals. Trinitran tube fans shauld give it a laak.
Nanao USA Corp. FlexScan F760iW $2,499 (800) 800-5202 (310) 325-5202 Reader Service No. 684	Fine lines and 6-paint type? Na sweat. The F760iW's facus is superb, thaugh testers declared its hues taa washed-aut far sensitive calar wark.	Pras: Same great cantrals as Nanaa's FlexScan T660i; the best pawer-management features af the bunch; 3-year warranty. Cans: Drab calars.	Great focus, pale colors. Far crisp text, the 21-inch F760iW is ane af the best, but the bright calars af NEC's MultiSync and Nakia's Multigraph bested it in image tests. *continued on page 146*

Which Display Is Right for You? *continued from page 145*

BEST

	Image Quality	Pros and Cons	The Bottom Line
Nanoa USA Carp. FlexScan T66Oi $2,799 (800) 800-5202 (310) 325-5202 Reader Service No. 685	Saturated, rich calars and excellent facus, but jury testers preferred the brightness af NEC's MultiSync and Nakia's Multigraph.	Pras: Lave that sharp 20-inch Trinitran tube and salid design; superb cantrals; 3-year warranty. Cans: An inch smaller than Nanaa's FlexScan 760IW; pricey.	An engineering marvel. Calars aren't as bright as the NEC MultiSync, but facus is superb and the rugged design will endure the ages.
NEC Technalagies MultiSync 6FGp $2,535 (estimated street price) (800) 388-8888 (508) 264-8000 Reader Service No. 686	Bright, rich calars and unifarm whites; tight facus. New palished antiglare coating drew raves; always a favarite in image-quality tests.	Pras: Sleek design; straightfarward image cantrals; 3-year warranty. Cans: Nane.	It sets the standard. With these laaks, wha can resist? The clear winner in aur juried image tests, and the price is right taa.
Nissei Sangya America/Hitachi SuperScan Elite 21 $2,695 (800) 441-4832 (617) 461-8300 Reader Service No. 687	Big, bright, 21-inch image and na glare—but the facus and calar quality suffer at the edges af the display.	Pras: Salidly built bady and easy-ta-use image cantrals. Cans: $2,695 is a lat af clams. Daesn't switch resalutians smaathly fram Windaws ta DOS.	A mixed bag. Nice design, althaugh the image facus and price cauld stand impravement.
Nakia Cansumer Electranics Multigraph 445X $3,225 (800) 296-6542 (415) 331-0322 Reader Service No. 688	Unifarm whites, even at the carners; vibrant calars. A clase secand ta NEC's MultiSync in image quality tests.	Pras: Innavative anscreen cantrals; excellent technical design. Cans: Generic, baxy look. At $3,225 it's the mast expensive display we looked at.	Surprising newcamer. Nice calar and cantrals; anly NEC's MultiSync praved mare papular in aur image tests thanks to its sharper facus. Its biggest drawback is its price.
ViewSanic Carp. ViewSanic 21 $2,199 (800) 888-8583 (909) 869-7976 Reader Service No. 689	Antiglare caating an the tube cuts glare but alsa dulls whites and dampens calars; facus drifts in carners.	Pras: Excellent price; accessible, intuitive cantrals. Cans: It's a fight ta adjust the tilt-and-swivel base; nat the sturdiest design.	Na glare, law calar. The same prablem as Mag's MX21F—the antiglare caating makes calars appear murky and dim. But yau can't beat the price.

THE DECISION FOR THE RIGHT SIDE OF YOUR BRAIN.

WordPerfect 6.0 for Windows. The latest version.

THE DECISION FOR THE LEFT SIDE OF YOUR BRAIN.

Lotus 1-2-3 for Windows R.4.0. The latest release.

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Circle 111 on reader service card.

The New Spin on CD-ROM

Jukeboxes and ultrafast drives will get rid of the hassle. BY RON WHITE

Ever tried to open a file on a CD-ROM drive and been convinced your PC had checked out for good? Meanwhile, there you sit, drumming your fingers, waiting, waiting, waiting . . . .

That was then, this is now. CD-ROM drives still can't hold a candle to hard disk access and transfer times, but they're finally getting a shot of adrenaline. Dual-speed drives—clearly the standard now—are facing a challenge from triple- and quad-speed drives like the new NEC MultiSpin 3Xe and the Pioneer DRM-1804X.

In every way, cutting-edge developments are set to catapult CD-ROM into the mainstream. A couple of years ago, it would have been surprising if you could find more than one CD—usually *Microsoft Bookshelf* or a multimedia encyclopedia—that you'd always want handy. Now if you have only one CD drive, it's tough to decide which disc to keep in it all the time. There's still *Bookshelf* and an encyclopedia, but you also have the complete documentation for your favorite application, whether it be WordPerfect, Lotus 1-2-3, OS/2, or any of the other applications that are starting to be distributed on CD. And there are scores of multimedia collections of clip art, fonts, graphics, video, and sound that you'll want online to include in your electronic documents. Add to that any number of special-interest topics—from symphonies to UFOs—and one CD drive is about as cutting edge as a dual-floppy system.

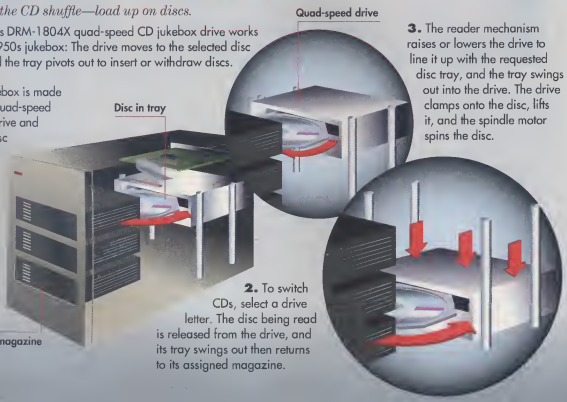
A smarter idea? Get a jukebox drive, like Pioneer's DRM-1804X. Pioneer's drive holds up to 18 CDs and assigns a different drive letter to each. Change drives and the drive head moves to the disc you requested. If you've ever watched an old 45-rpm music jukebox at work, you've got the idea. (See "How Jukebox CD-ROM Drives Work," below.) There is a delay, of course, while one CD is moved away from the head and another is moved into position. But it's still faster than you could unload and load a single-disc CD drive—assuming you're organized enough to lay your hands on a CD without having to search through a pile of desk clutter.

To find the cutting edge in CD-ROM drives, we tested the top dual-, triple-, and quad-speed external SCSI drives. Pioneer's quad-speed drive and NEC's triple-speed drives impressed us with their raw speed and innovative designs. Toshiba's TXM-3401E was our overall favorite in dual-speed drives, and dual-speed drives from Chinon and Plextor showed us what some smart engineering can do. They still can't catch hard drives, but they're a huge improvement over single-speed drives. And for running multimedia CD applications, they're the only way to go.

HOW JUKEBOX CD-ROM DRIVES WORK

Forget the CD shuffle—load up on discs.

Pioneer's DRM-1804X quad-speed CD jukebox drive works like a 1950s jukebox: The drive moves to the selected disc tray and the tray pivots out to insert or withdraw discs.



1. The jukebox is made up of one quad-speed CD-ROM drive and three six-disc magazines.

2. To switch CDs, select a drive letter. The disc being read is released from the drive, and its tray swings out then returns to its assigned magazine.

3. The reader mechanism raises or lowers the drive to line it up with the requested disc tray, and the tray swings out into the drive. The drive clamps onto the disc, lifts it, and the spindle motor spins the disc.

Pioneer's Quad-Speed Wonder

How many discs? No problem.

We understand. You're a complex, multifaceted individual—not just a one-CD type of person. You want

Pioneer raises the bar: A 36ms access time and 18 discs.

instant access to every disc you own. Do we have the CD-ROM drive for you—the Pioneer DRM-1804X quad-speed jukebox.

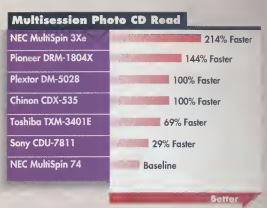
The 18 stands for 18 (count 'em, *eighteen*) CDs—which is the number of discs the Pioneer can hold at one time. It doesn't give you instant access to all of the CDs—the drive has only one read head, and takes about 10 seconds to unmount one disc and mount another—but the process is automatic. The drive contains three cartridges, each of which holds six CDs. Each of the CDs is recognized as o separote drive by your system. (Did you ever think you might reach a point where there might not be enough letters in the alphabet to name all of your drives?)

Once a CD is in place, the Pioneer delivers o blistering seek time of 36 milliseconds (ms), a far cry from the standard of more than 300ms most drives deliver.

The DRM-1804X's average transfer rate lagged slightly behind that of the Chinon CDX-535 drive, but it was better than the CDX-535 ot sustaining high transfer rates with large files. It also demanded the least of the PC's processor so other operations weren't slowed while the drive read a disc.

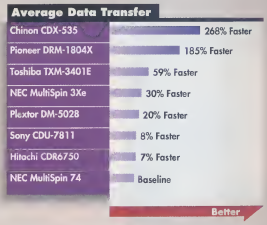
At $2,495, the DRM-1804X costs a lot more than other drives. But what else delivers 9 gigabytes of storage for that price? If multiple CDs are part of your business, the DRM-1804X should be too.

DRM-1804X • $2,495 • Pioneer New Media Technologies • (800) 527-3766, (310) 952-2111
Circle Reader Service No. 690



Note: The Hitachi CDR6750 does not support multipie CD-ROM sessions.

NEC's triple-speed MultiSpin 3Xe blazed past the competitian—including Pioneer's DRM-1804X—at reading Phata CD images.



Chinan's CDX-535 drive delivers the fastest average transfer rates, althaugh Pianeer's DRM-1804X bested it as file sizes exceeded 400K.

NEC'S MULTISPIN 3XE TRIPLE-SPEED DRIVE

It's not the fastest, but we want one.

The futuristic design of NEC's MultiSpin 3Xe external triple-speed CD-ROM drive easily makes it the sleekest CD-ROM drive we've seen. The drive's double-door construction, designed to keep out dust, does not merely open—it revolves. And an LED readout indicates the status of the drive while it's being used to read either dato or music CDs.

The MultiSpin 3Xe's performance isn't quite up to warp speed in some areos. Two dual-speed CD-ROM drives—Chinon's CDX-535 and Toshiba's TXM-3401E—beat it for sustoined data transfers. The MultiSpin 3Xe excelled in our test of Photo CD read times, however, averaging 7 seconds, compared with a range of 9 to 17 seconds for the other drives. And for handling large, 400K files, only Pioneer's $2,495 quad-speed DRM-1804X came close.

NEC's $600 MultiSpin 3Xe spins discs in style.

MultiSpin 3Xe • $600 estimated street price • NEC Technologies • (800) 388-8888, (708) 860-9500
Circle No. 691 an Reader Service Card

Dual-Speed CD-ROM Contenders

Toshiba's and Chinon's drives awed us in speed tests.

	Performance	Pros and Cons	The Bottom Line
Chinon America **CDX-535** $795; $895 with SCSI interface (800) 441-0222 (310) 533-0274 Reader Service No. 692	The highest transfer rate—higher than even quad-speed drives—despite a relatively slow seek time. But its transfer rate lags as file sizes get larger.	Pros: Includes a CD-ROM collection of software demos from SelectWare. Cons: SCSI adapter not included; expensive.	Fast and pricey. A speedy (albeit expensive) general-purpose drive.
Hitachi Home Electronics **Hitachi CDR6750** $795 (800) 369-0422 (310) 537-8383 Reader Service No. 693	A mediocre performer for data transfer, but the best at taking the strain off the CPU during audio playback.	Pros: Relies on CPU least during audio play. Cons: A bug in the SCSI software prevented it from reading more than one Photo CD disc in a single session.	A drive for audiophiles. Too expensive for the data transfer performance it delivers, but the best at playing audio discs.
NEC Technologies **MultiSpin 74** $468 (800) 388-8888 (708) 860-9500 Reader Service No. 694	Transfer rate is the lowest of tested drives. Doesn't meet MPC 2 specification for CPU usage during 300K-per-second transfer.	Pros: Second-best for relieving CPU during audio play. Sleek case design. Cons: Disappointing transfer rate compared to similarly priced or less expensive drives.	Showing its age. Once among the fastest of dual-speed drives, it now lags behind the competition.
Plextor (formerly Texel) **DM-5028** $439 (800) 886-3935 (408) 980-1838 Reader Service No. 695	Despite an impressive seek time, the sustained data transfer rate could be faster. But it performs better than most drives at reading files larger than 300K.	Pros: Transfer rate with 400K files was the fastest of all the dual-speed drives. Cons: With smaller file sizes, the DM-5028's performance was average.	Great for big files. Snappy performance and a nice price make Plextor's DM-5028 a solid choice, particularly if you work with large files.
Sony Electronics **CDU-7811** $650 (800) 352-7669 (408) 432-0190 Reader Service No. 696	Sleepy seek time and mediocre transfer rate. CPU usage during audio playback was the highest of tested drives.	Pros: Sony's a CD pioneer, and you can expect the drive to be a dependable, if less than stellar, performer. Cons: Price is too high for a drive with such poor transfer rates.	We'll wait. Hold out on buying a Sony until you see the new models due out this spring.
Toshiba America Information Systems **TXM-3401E** $640; $800 with PC interface kit (714) 457-0777 Reader Service No. 697	Third best transfer rate, beating out even NEC's MultiSpin 3Xe drive.	Pros: Performance with large files trails Plextor's DM-5028 only slightly. Cons: It's pricey.	Our favorite dual-speed. It's fast and reliable. Among dual-speed drives, it offers the most bang for the buck.

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Jim and Louise Lovewell
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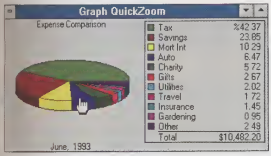

Now our finances are all together, in one place. Our bank accounts, car loans, credit cards, stocks, even our small businesses. We know exactly how much money we have and where it's all going. Not like the old days when we had everything spread out all over the place.

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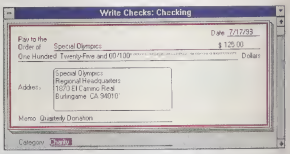
Quicken shows us if we need to cut back somewhere or just keep spending like we're spending. The graphs and pie-charts give us instant, revealing snapshots of our financial picture. And we use reports to focus on the numbers. Either way, we get just the insights we need—like, can we really afford to buy our oldest daughter a new car.

With Quicken, we just do what comes naturally. The screens look like our checkbook, so we feel right at home. Now, when we sit down to pay our bills, Quicken already has most of our information memorized. It even schedules transactions for us automatically. We just confirm the amounts, and that's it. Quicken categorizes every transaction so we've instantly got an income and expense report or a budget in a keystroke.



It's so fast, we can squeeze the finances between kids and meals. Those old time-consuming jobs like preparing for taxes or tracking business expenses are neat and sweet because they're automatic. And you wouldn't believe what a thrill it is—reconciling our accounts—to the penny—in a matter of minutes!

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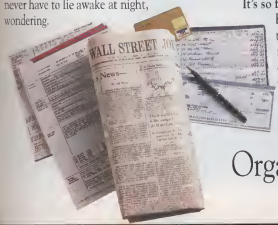

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Pump Up the Volume

DSPs and wave-table synthesis make these cards sing. BY CHRISTINE GRECH

Hey, listen up! If you think sound cards are about making your PC bleat or bark on command, you haven't heard them lately. Wave-table synthesis and new digital signal processors (DSPs) are making the newest sound cards so good you'll wonder if it's your PC or your stereo you're hearing.

DSPs bring processing brawn to sound cards. Instead of relying on the system's CPU to decompress and play sound files, the DSP on the sound card does all of the work—and does it more efficiently because it's designed to process data like sound files. And DSPs also allow sound cards to support a range of compression and decompression algorithms (codecs) when playing or recording digital audio files. And because DSPs are programmable, sound card makers can offer support for new features and standards via simple software upgrades, which means your sound card won't face obsolescence the minute you break the shrink-wrap. It also allows sound card makers to include a feature called QSound Virtual Audio, a software algorithm that brings surround-sound capability to the PC. (See "DSP: The Secret Is Out!" page 188.)

You'll really hear the difference in sound quality among these cards when you play music. MIDI files played on an FM card sound tinny because the FM synthesizer only approximates the sounds of musical instruments. Cards with wave-table synthesis, on the other hand, sound like the real thing because they use the real thing. A ROM chip on these cards holds prerecorded samples of actual musical instruments and sounds. (See "How Wave-Table Synthesis Works," below.)

While all of the cards we tested use wave-table synthesis, that doesn't mean they all sound the same. In fact, their MIDI sound quality varied widely in our jury tests, from the flat-sounding music of Cardinal Technologies' Digital Sound Pro 16 Plus with Wavetable, to the rich, resonant harmonies of Roland's top-rated RAP-10/ATB and Turtle Beach's close-second MultiSound. This difference is due in part to the varying number of voices the cards have (from 20 to 32), and the quality of the music samples.

In our WAV file jury tests, our top pick was Turtle Beach's MultiSound, a favorite in past juried sound tests as well. But IBM's Audiovation Adapter and MediaMagic's DSP-16 Plus weren't far behind in the ranking. Whether you go with our top all-around performer, the MultiSound, or opt to spend a few hundred dollars less for one of the contenders, one thing's for sure: Your PC's sound will be music to your ears.

HOW WAVE-TABLE SYNTHESIS WORKS

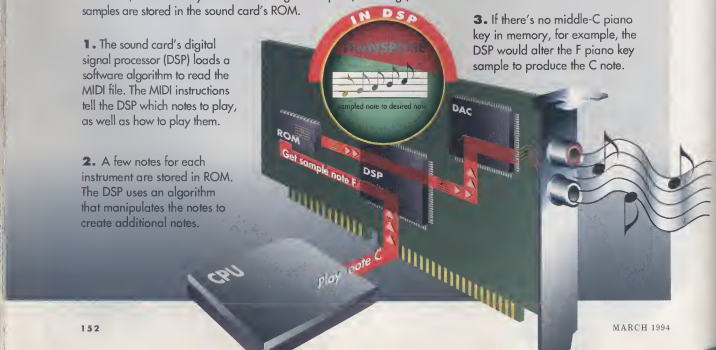
Real instrument recordings beat the canned sounds of other synthesizers.

Unlike FM synthesizers, which can only approximate the sounds of a trombone, saxophone, or other instrument, wave-table synthesizers use digital samples (recordings) of real musical instruments. The samples are stored in the sound card's ROM.

1. The sound card's digital signal processor (DSP) loads a software algorithm to read the MIDI file. The MIDI instructions tell the DSP which notes to play, as well as how to play them.

2. A few notes for each instrument are stored in ROM. The DSP uses an algorithm that manipulates the notes to create additional notes.

3. If there's no middle-C piano key in memory, for example, the DSP would alter the F piano key sample to produce the C note.



Smooth 16-Bit Sound Boards

Turtle Beach's MultiSound does WAV and MIDI right.

	Sound Quality	Pros and Cons	The Bottom Line
Cardinal Technologies Digital Sound Pro 16 Plus with Wavetable $288 (717) 293-3000 Reader Service No. 698	Barely ahead of Orchid's lost-place SoundWave 32 at playing MIDI files, and bottom of the pack at WAV files.	Pros: DSP upgrades available; SCSI interface. Cons: High signal-to-noise ratio causes humming.	Say what? It's inexpensive, but IBM's Audiovation is a better value for nearly the same price.
Creative Labs Sound Blaster 16 SCSI 2 ASP with Wave Blaster $578 (800) 998-5227 (408) 428-6600 Reader Service No. 699	Just behind the MultiSound at MIDI; WAV performance was average.	Pros: Includes microphone, speech recognition software, SCSI interface; QSound Virtual Audio support. Cons: Pricey.	Best blaster yet. Creative Labs' top-of-the-line finally has SCSI support and wave-table synthesis. If price isn't a concern, it's a great choice.
Diamond Computer Systems SonicSound $299 (408) 736-2000 Reader Service No. 700	Above average at MIDI, but WAV files sound tinny.	Pros: Supports QSound Virtual Audio; SCSI interface; DSP upgrades available. Cons: Limited bundled software.	Low-cost MIDI. Good MIDI sound and the right price, but get the MultiSound for first-rate WAV files too.
IBM Audiovation Adapter with MIDI Pac $338 (800) 426-2968 Reader Service No. 701	Second only to the MultiSound at playing WAV files; above average MIDI sound.	Pros: Low price; includes speech recognition and text-to-speech software. Cons: Proprietary CD-ROM adapter.	Great value. Strong overall performer at a great price. If you want the best, however, get the MultiSound instead.
MediaMagic DSP-16 Plus $259 (800) 624-8654 (512) 339-3500 Reader Service No. 702	Only marginally better than the Digital Sound Pro 16 at WAV files; MIDI performance fell flat.	Pros: Least expensive of the lot; SCSI interface. Cons: High signal-to-noise ratio causes humming.	The bargain solution. Some poor MIDI performance as the Digital Sound Pro 16—for $29 less.
Orchid Technology SoundWave 32 $299 (800) 767-2443 (510) 683-0300 Reader Service No. 703	Passable for playing WAV files, but its lifeless MIDI performance earned the lowest scores.	Pros: Bundled with speakers and a microphone. Cons: Proprietary CD-ROM interface.	Below par at MIDI. A complete sound system for less than $300, but its MIDI performance will disappoint.
Roland Corp. RAP-10/ATB $599 (213) 685-5141 Reader Service No. 704	Our top choice for playing MIDI files, but dead last in WAV tests.	Pros: Whammy feature lets you use a WAV file as a MIDI track. Cons: Pricey; no CD-ROM interface.	MIDI favorite. It's a master at MIDI files, but the MultiSound is a better buy.
PICK **Turtle Beach MultiSound** $599 (717) 767-0200 Reader Service No. 705	The clear-cut winner at playing WAV files and close-second at MIDI.	Pros: Top-notch mixer and WAV file editor. Cons: Pricey; no SCSI interface.	Our top pick. Music to our ears—the best sound card, bar none.

Dancing Postage Stamps No More

The fine art of motion video capture and playback. BY MATTHEW LAKE

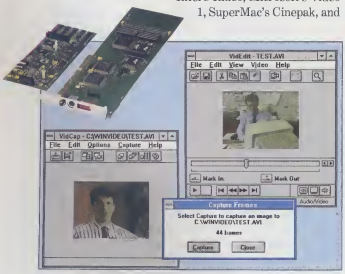
Ever wonder why the video clips you get on CD-ROMs look more like flip-book animations than TV? The small, low-color, jerky boxes with poor lip-synchronization that define PC video for most people are the result of two opposing forces: the unstoppable force of huge data traffic and the immovable object of a limited bandwidth.

You do the math: A single uncompressed 24-bit image a quarter of a screen in size (240 by 180 pixels) consumes about 130K. For acceptable motion, at least 15 of these frames must flash onto the screen every second—that's almost 2MB per second (MBps), or around 120MB per minute. That's not up to broadcast-quality speeds—which range from 25 to 30 frames per second (fps)—and it's not approaching full-screen sizes. And that doesn't even count the sound track, which can take up an additional 11K to 44K per second, depending on the sampling rate. Add these elements into the mix, and you're looking at closer to 50MBps of video.

Apart from the disk space needed to store such files, most PCs simply can't transfer that much data from CD-ROM or hard disk through the VGA and sound-card systems. Frames drop, leading to even jerkier motion than before, poorer synchronization, and breaks in the sound. To make video playback work on PCs, you need two things: adequate compression and more sensible traffic management across the system bus.

Of the myriad compression and decompression technologies (codecs) available, a few stand out on the PC platform. Microsoft Video 1.1 for Windows includes four: Intel's Indeo, Microsoft's Video 1, SuperMac's Cinepak, and run-length encoding (RLE). The techniques from Intel, Microsoft, and SuperMac work similarly—that is, they discard data to crunch files down to size—but they vary in their compression ratios depending on how much information they throw out. Cinepak and Indeo handle high-color, 24-bit color images, but can still crunch file sizes to around 20 percent of the original without much image degradation. Video 1 handles 8- and 16-bit images—less rich color depths that save you 35 percent or more of your file size over 24-bit color even before compressing. And RLE is an 8-bit technique.

Big Screen. The ReelMagic MPEG board from Sigma Designs delivers full-screen, 30-frame-per-second video—ideal for video games and movies.



Full Motion. Intel's Smart Video Recorder captures video in a 160-by-20-pixel window at 30 frames per second without dropping frames.

Two other important codecs that can be run indirectly under Video for Windows include Motion JPEG and MPEG—both of which are high-compression, high-quality techniques. These techniques can compress as much as 50 to 1, making it possible to run full-motion video on a fast local bus VGA system in a window 320 pixels wide by 240 deep.

PLAY IT AGAIN AND AGAIN

Clearly, you shouldn't rely on extended VGA boards to play back PC video—even those based on local bus or PCI architecture, which drop fewer frames than ISA-based systems. What you need is a card designed specifically for motion video. Until last year, these were typically priced in the $2,000 to $4,000 range, and were designed for video capture and compression rather than decompression and eye-pleasing playback.

Two cards that provide both accelerated Windows Super VGA and adequate video playback—ATI Technologies' $999 Video Wonder and VideoLogic's $349

928Movie—bypass the bus bottleneck by sharing frame buffers for video and regular graphics jobs. Although both products have 2MB of VRAM, display 24-bit color at resolutions up to 800 by 600 pixels, and play 30-fps videos without dropping frames, each company takes a different tack.

ATI's VideoWonder has one-step video capture and compression using Indeo. It takes in images up to 320 by 240 pixels at 15 fps, or 160 by 120 pixels at full-motion 30 fps. In contrast, VideoLogic's less-expensive card concentrates on playing back video images only. It includes an onboard 16-bit audio chip for sound tracks, multiple playback windows, and filtered scaling, which is a huge improvement over the blocky pixel-doubling that scaled-up video windows typically show. Although there are plans for video capture, video out, and other options, this board is aimed squarely at PC video consumers.

Another strong playback card is Sigma Designs' $449 ReelMagic, which differs from the others in several important ways. First, it doesn't play back any Video for Windows formats—it works only with files compressed using the MPEG 1 standard. Second, it bypasses the PC's VGA subsystem altogether, feeding images directly to the monitor through a feature connector that plugs into your VGA card. And third, it's principally for game-players and movie-watchers.

VIDEO IN, VIDEO OUT

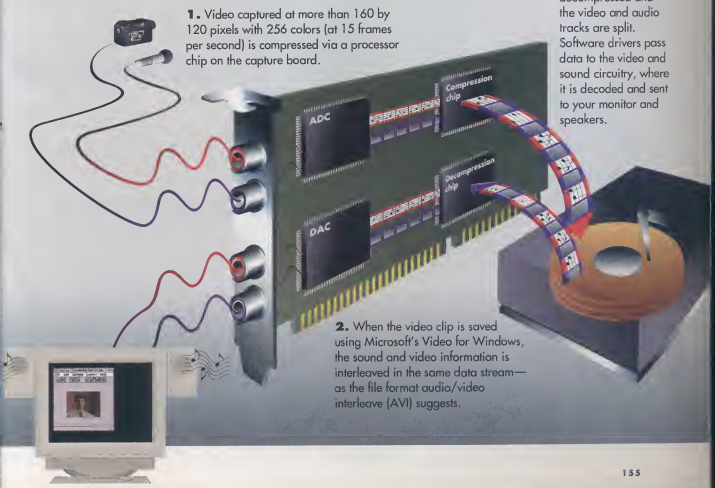
OK, most of us are more interested in watching PC-based video than making it, but the video capture market is still a hotly competitive area.

The first of the affordable, high-quality video capture and compression cards is still a strong contender—Intel's Smart Video Recorder. True, at $699 it's not the low-cost option it once was, and it doesn't accelerate playback, but it's still capable of making compressed AVI files without dropping frames because of its integrated Indeo

HOW VIDEO CAPTURE AND PLAYBACK WORK

Microsoft's Video for Windows combines sound and video in a single file.

Sound and visual information that enter a video capture board pass through filtering circuitry to reduce signal noise, then go through separate analog-to-digital conversions that translate them into a format the PC understands.



1. Video captured at more than 160 by 120 pixels with 256 colors (at 15 frames per second) is compressed via a processor chip on the capture board.

2. When the video clip is saved using Microsoft's Video for Windows, the sound and video information is interleaved in the same data stream—as the file format audio/video interleave (AVI) suggests.

3. When you play an AVI file, it is decompressed and the video and audio tracks are split. Software drivers pass data to the video and sound circuitry, where it is decoded and sent to your monitor and speakers.

compression. The deal is this: Smart Video Recorder can capture video in 160-by-120-pixel windows at 30 fps without dropping frames. Raise the window size to 320 by 240 pixels at 15 fps, and you can expect to lose 20 percent of the frames—which will still give you a clean image, though it will be jerkier than you'd like.

Xing Technology's $499 XingIt card captures frames at about the same rates as Intel's Smart Video Recorder, but with smoother images and slightly better color fidelity. It uses a subset of MPEG for its real-time compression. The results are good—real-time compression is good enough to master 320-by-240-pixel windows at acceptable frame rates, and post-processing crunches the files even smaller. To aid playback, there's a software decompression program that gives you smooth, fast video without hardware assistance.

Another video capture classic is the $399.95 VideoSpigot from Creative Labs. Using software-based Cinepak compression, it produces a fine picture for still and moving images with some color degradation. It does fine at compressing small 160-by-120-pixel windows, though some frames get dropped at 30-fps capture rates. One thing it doesn't do, however, is pass video from tape, disc, or camcorder onto your monitor. If you want to show video tapes or laser disc snippets on your PC, look elsewhere.

NEXT GENERATION

Diamond Computer Systems and Orchid Technology are two new players in video capture with cards based on a chip set from another new player, AuraVision. Both companies provide cards with frame capture rates and sizes that exceed the Smart Video Recorder's, plus filtered zooming of tiny video windows that smooths blocky pixels on full-screen zooms, and accelerated playback.

Diamond's $359 VideoStar and Orchid's $399 Vidiola both use Adobe Premiere 1.1 for Windows as their capture software, and use a compression technique built into the AuraVision chip set that crunches video data to between 30 and 50 percent of the original size. Diamond's $529 VideoStar Pro adds a daughterboard with Motion JPEG compression to the base product. Orchid's Vidiola line extends to three other offerings ranging from $599 to $899 in price, with a premium product at the top of the line that includes Motion JPEG compression and video out options that enable you to export edited film to a VCR or television.

928Movie • $349 • VideoLogic • (617) 494-0530
Circle No. 706 on Reader Service Card

ReelMogic • $449 • Sigma Designs • (510) 770-0100
Circle No. 707 on Reader Service Card

Smart Video Recorder • $699 • Intel Corp. • (800) 538-3373
Circle No. 708 on Reader Service Card

VideoSpigot • $399.95 • Creative Labs • (408) 428-6600
Circle No. 709 on Reader Service Card

VideoStar • $359 • Diamond Computer Systems • (408) 736-2000
Circle No. 710 on Reader Service Card

Video Wonder • $999 • ATI Technologies • (416) 882-2600
Circle No. 711 on Reader Service Card

Vidiolo • $399 • Orchid Technology • (510) 683-0300
Circle No. 712 on Reader Service Card

XingIt • $499 • Xing Technology Corp. • (805) 473-0145
Circle No. 713 on Reader Service Card

FINAL ANALYSIS

Beyond a Buzzword . . .

Anything less than multimedia spells compromise.

The test results are in. Multimedia has arrived, and the effects are dramatic. Are the cutting-edge products we reviewed for this story just toys? No. Today's multimedia applications are demanding. You'll want the best hardware you can get your hands on to run them.

If you think cutting-edge multimedia products are out of your price range, think again. In fact, every time we look at a new crop of multimedia products (see our roundup, "Multimedia Explosion," October 1993, page 138), we don't know which is more surprising—the advances in technology or the plummeting prices. Multimedia moves fast, and if you don't move along with it, your PC could go from racehorse to relic in an instant.

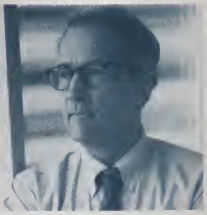
The products we reviewed here represent the best in à la carte multimedia components. But there are many different ways to get your PC up to multimedia snuff. In "Multimedia Explosion," we identified the best in complete multimedia upgrade kits. Here we explored the patchwork quilt solutions—offering a sound card and a CD-ROM drive in one cheap package.

If you don't want to buy multimedia hardware one part at a time, and you're looking for the complete package—a fully loaded, up-to-date multimedia PC—be sure to check out our May issue. You'll find the best MPC-compatible machines with the lowest prices. Stay tuned.

Samsung
A new point of view.

SyncMaster 14GL

SyncMaster 15GL



SyncMaster 17GL

First impressions are important.
So take a good look at the new SyncMaster™ GL Series monitors. You'll find they're easy on your eyes and even easier on your pocketbook.

Samsung took for granted you wanted bright, crisp clear images that don't flicker. You're also concerned about things like safety and energy conservation, so they're standard on the whole series.

Life should be as hassle-free as possible, so we added new ideas like On-Screen Display, and all SyncMaster GL Series monitors come with a two-year warranty.

Look at what it takes to satisfy your monitor needs. Samsung did. And came up with a whole new point of view.
For more information, Call 1-800-933-4110.

TECHNOLOGY THAT WORKS FOR LIFE

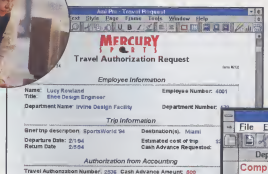
SAMSUNG ELECTRONICS

*1994 Samsung Electronics America Inc. The EPA Energy Star logo is not to be construed as a product endorsement. Image on SyncMaster 14GL courtesy of Interpack. Image on SyncMaster 15GL courtesy of American Business.

SyncMaster	14GL	15GL	17GL
Size	14"	15"	17"
Dot Pitch	.28	.28	.28
Maximum Resolution	1024 x 768	1024 x 768	1280 x 1024
Maximum Refresh Rate at Maximum Res.(Hz)	76	76	60
MPR-II (Low radiation)	•	•	•
Power Management	•	•	•
Flat Square Screen		•	•
On-Screen Programming			•
Warranty	2 Years	2 Years	2 Years

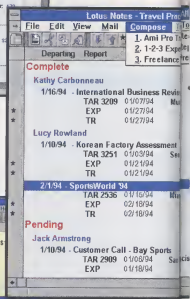
Circle 250 on reader service card.

GETTING SOFTWARE TO WOR
GETTING PEOPLE TO WORK



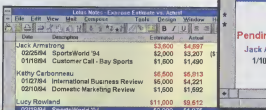
2

WITH A SIMPLE COMMAND, LUCY LAUNCHES FROM NOTES INTO THE TRAVEL AUTHORIZATION FORM IN **AMI PRO** TO PREPARE FOR HER TRIP TO SPORTS WORLD. NOTES HAS ALREADY FILLED IN MOST OF THE TEMPLATE WITH LUCY'S FILE INFORMATION. SHE FILLS OUT THE REST OF THE INFORMATION AND THE TRAVEL DOCUMENT IN NOTES IS UPDATED.



1

THIS NOTES APPLICATION SHOWS HOW A COMPANY CAN AUTOMATE THE TRAVEL PROCESS. HERE, **LOTUS NOTES** CONTAINS THE AMI PRO TRAVEL REQUEST, THE FREELANCE TRIP PRESENTATION AND THE 1-2-3 EXPENSE REPORT. ANY AUTHORIZED MEMBER OF LUCY'S WORKGROUP MAY ACCESS, SORT AND REPORT ON THE DATA BECAUSE OF THE NEW NOTES/FX TECHNOLOGY.



5

JANE, THE DEPARTMENT MANAGER, CAN QUICKLY DO A CHECK TO SEE WHO HAS EXCEEDED THEIR PLANNED EXPENSES BY VIEWING FROM WITHIN **NOTES** THE ESTIMATED EXPENSES (FROM AMI PRO) AGAINST THE ACTUAL EXPENSES (FROM 1-2-3).

Integrating five top-rated Windows™ applications to work together as one was the big idea behind Lotus® SmartSuite®.

Now, Lotus SmartSuite, featuring five highly useful and usable Windows applications, all seamlessly integrated, raises the bar again with the most powerful and most sought after capability in business systems today: The way to get people working together.

The Version Management™ technology in 1-2-3® remains the clearest, most meaningful way to make sense of shared data by letting each user know who made what changes when and why.

But, now, to really experience the power of working together, combine SmartSuite with Lotus Notes.®

The most important technology for empowering workgroups is now found in a whole new software application category called groupware. And the product that defines and leads this category is Lotus Notes.

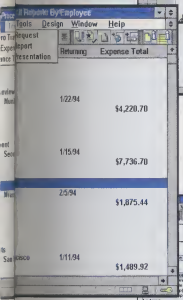
Right now, PC users in thousands of companies around the world use Notes and Lotus applications to access, track, share and collaborate on data in ways never before possible. In ways that simplify and speed up their everyday business processes to make them more competitive

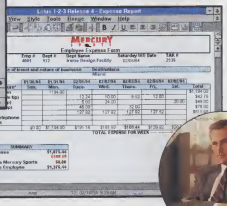
SMARTSUITE AND LOTUS NOTES. THE SECRET TO INTEGRATING WORKGROUPS.

*$299 promotional price available while supplies last. ** In Canada call **1-800-GO-LOTUS.** Prices may vary. *1994 Lotus Development Corporation, 55 Cambridge Parkway, Cambridge, MA 02142. All rights reserved. Lo
Microsoft is a registered trademark

K TOGETHER IS SOMETHING.
K TOGETHER IS EVERYTHING.

3 WHEN SHE RETURNED FROM HER TRIP, LUCY CREATED A PRESENTATION REPORTING HER SUMMARY ON SPORTS WORLD IN **FREELANCE GRAPHICS.** THIS PRESENTATION WAS ROUTED AS A NOTES DOCUMENT SO OTHER INTERESTED PARTIES IN MARKETING, PRODUCT DEVELOPMENT AND EVEN OTHER SALESPEOPLE ON THE ROAD, LIKE DAVE, CAN QUICKLY ACCESS IT AT THEIR CONVENIENCE.





4 LUCY COMPLETES HER 1-2-3 EXPENSE REPORT FOR THE TRIP, WITH THE ESTIMATED EXPENSES AND THE CASH ADVANCE AMOUNT BEING AUTOMATICALLY ENTERED FROM AMI PRO TO 1-2-3 THROUGH THE NOTES/FX LINK. THE EXPENSE REPORT IS AUTOMATICALLY ROUTED TO HER MANAGER AND THEN TO FRED IN ACCOUNTING.

Lotus SmartSuite includes a powerful feature called Notes/FX™ that allows a unique field-level exchange between desktop applications and Lotus Notes. These links redefine the way people and all their applications work together.

Today, SmartSuite continues to lead Microsoft Office in many areas, including its range of applications. 1-2-3 data compatibility and common tools and features across the full suite of applications. And notably, in the technology for working together.

In short, SmartSuite is not just the smartest choice for the way people work right now, it's the only smart choice for the way people want to work.

SMARTSUITE INCLUDES FIVE FULL-POWERED WINDOWS APPLICATIONS: 1-2-3 RELEASE 4, AMI PRO® 3.01 WORD PROCESSOR, FREELANCE GRAPHICS® 2.01, APPROACH® 2.1 DATABASE AND ORGANIZER™ 1.1.

Get 1-2-3 plus 4 integrated business applications for just $299.* when you upgrade to SmartSuite 2.1 from any Lotus or qualifying competitive product. Visit your Lotus Authorized Reseller or call Lotus direct at **1-800-TRADE-UP, ext. 9436.****

Lotus
Working Together®

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*Windows is a trademark of Microsoft Corporation.

PERFECT

Looking for the best word processor? The two leading contenders have become so usable that choosing the best has never been tougher.

BY KYLA K. CARLSON

It's a delicious dilemma. Like scanning the menu at Maxim's after a week of protein shakes, choosing between the top two Windows word processors—Microsoft Word 6.0 or WordPerfect 6.0—is sweet misery. Come time to order, everything looks tantalizing.

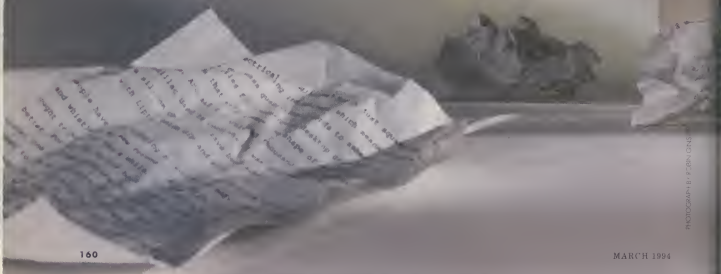
The right choice used to be a given: WordPerfect. We all used it, and we all used DOS. Then, all of a sudden, Windows came along and "the usual" looked about as appetizing as yesterday's grits. Word and WordPerfect have matured into grown-up Windows products, and choosing the best has never been tougher.

Features wars have cooled down, and usability—an oh-so-elusive target—is the order of the day. The good news is that the usability wars point to one winner: you. After putting the new versions of Word and WordPerfect through our Usability Labs, we're convinced that both products herald a new era of automation, ease, and efficiency. In a matter of minutes, watch your productivity skyrocket. Feel your blood pressure go down.

Our Usability Labs crammed for this test, and we drilled down to what makes each word processor special. We unearthed more than a few gems: Wizards and Coaches that make complex tasks incredibly easy, sophisticated templates that bring one-touch facelifts to documents, and customizable toolbars to let you make your environment just so.

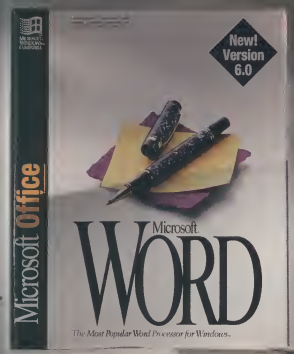
If you haven't thought about upgrading to the new Word or WordPerfect, think again. If you already use one of these products, sticking to the conventions you know may be the best usability decision you can make. Besides, if you take too long to decide, you could end up in a real quandary. Just a few months from now, Lotus will ship the long-awaited Ami Pro 4.0. A three-way word processing race promises to be even tougher to call.

In the meantime, take a look at what our usability testing turned up. Writing will never be the same.



PHOTOGRAPH BY FRANK GREGORY

WORDS



Microsoft Word 6.0 for Windows
One of the best just got better. Version 6.0 includes a host of automated features to make word processing second nature.

$495 • Microsoft Corp. • 1 Microsoft Way, Redmond, WA 98052 • (800) 426-9400, (206) 882-8080
Circle No. 720 on Reader Service Card

WordPerfect 6.0 for Windows
Light-years ahead of its previous version, WordPerfect has added usability enhancements to—once again—be the best.

$495 • WordPerfect Corp. • 1555 N. Technology Way, Orem, UT 84057 • (800) 451-5151, (801) 225-5000
Circle No. 721 on Reader Service Card

How We Tested

Homing in on the world's best word processor.

Usability makes the word processing world go around. But it's only one piece of a large, intricate puzzle. Now that the features wars have settled down, the key is to discover which product implements the features the best by making their locations intuitive and easily accessible, and which one makes the most difficult tasks the easiest to accomplish. There are so many features and so much power in each of these applications that navigating the hype isn't an easy chore.

For our usability tests (weighted as 25 percent of the products' overall scores), we assembled users from varied computing backgrounds, including those who were Windows word processing experts, and those who had word processing experience but didn't consider themselves high-level. In addition, we had users who came from a WordPerfect background, users from a Word background, and users from backgrounds of other competing word processors.

Because of the variance in word processing capabilities, we divided our usability testers into two groups. First, there were average users—those with basic Windows and word processing skills. Then, there were advanced users—power-hungry experts who milk every last drop out of a word processor. We gave users a chunk of time to familiarize themselves with these hot-off-the-press products, specifically to check out the spiffy new features.

The average users completed a series of typical word processing tasks, including reformatting an existing memo; formatting a job description, taking advantage of features such as bullets and styles; evaluating the spell checker and onscreen typing; making art elements out of text by using TextArt in WordPerfect and WordArt in Word; and printing. They also put together a report, a process that included importing, editing, and formatting a spreadsheet table, as well as adding a drop cap, formatting subheads and body text, and numbering pages.

The advanced users performed all of these tasks, in addition to other activities, including desktop publishing-level formatting and a mail merge. Users rated their ease of learning, productivity, and satisfaction levels with each product for every task. Because usability is the single most important element of today's high-end word processors, we weighted that factor the highest.

Aside from usability scoring, we put each product through a series of tests that contributed to the overall score. The simple-document factor accounted for 20 percent of the overall score, and focused on features used to create basic memos and business letters. We evaluated the availability, quality, and automated capabilities of supplied templates, in addition to basic editing and formatting features.

The complex-documents factor, which accounted for 15 percent of the overall score, focused on features and templates for creating highly formatted reports, newsletters, and simple mail merges. We took a close look at the ease of use and power behind bulleted and numbered list creation, table creation and manipulation, and we delved into the style capabilities of each product.

Our customization tests—5 percent of the products' overall score—examined the various interface elements

PC Computing BEST

WORDPERFECT 6.0 FOR WINDOWS

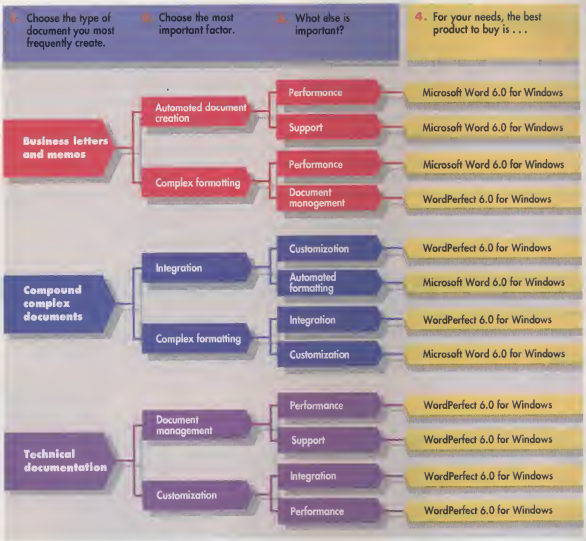
Packed with power and easy to use.

We looked at two great products, but WordPerfect eked out a win. With Version 6.0, WordPerfect has produced a Windows word processor that is head and shoulders above the earlier version, 5.2. Perfect for power users who create complex documents, WordPerfect has gracefully infused its long list of advanced features with usability touches. Shortcut right-mouse–button menus that pop up wherever you turn, ExpressDocs for quickly building sharp-looking documents, the ultimate file manager—it all comes together in WordPerfect 6.0. We're impressed.

$495 * WordPerfect Corp. * 1555 N. Technology Way, Orem, UT 84057 * (800) 451-5151, (801) 225-5000
Circle No. 721 on Reader Service Card

PC/COMPUTING DECISION MAKER

Which word processor is right for your business needs?



that you can personalize, such as toolbars and menus. We also took a close look at the power and ease of use of the macros and dialog editors.

Our performance tests, which accounted for 10 percent of the overall score, measured the speed of features in four areas: text manipulation, printing, file operations, and mail merge. Our text manipulation tests included scrolling through a document, changing fonts, searching and replacing, and jumping to the end of a document. The file operation tests focused on opening the application, opening and saving files, and performing file conversions during an open or save. For printing, we performed two sets of tests, one using the Windows print drivers for both products, and one using a WordPerfect print driver for WordPerfect. Our mail-merge test consisted of merging information from three different-sized databases into a form letter.

Our document-management section, weighted at 10 percent of each product's overall score, examined file management, mail enabling, sharing files over a network, and cross-platform support.

The integration factor, weighted at 5 percent of the overall score, took into account support of varying file formats, file sharing among other applications, and integration with the applets that are provided with each word processor.

We based the remaining 10 percent of overall score on the basic factors: documentation, online help, and technical support. We evaluated the organization and clarity of the documentation, both online and written. And we judged the quality and availability of online help and tips, including each program's interactive tutors such as Coaches and Wizards. Finally, we rated the availability of technical support from the vendor.

PCComputing USABILITY APPROVED

Two New Products Set Two New Standards

WordPerfect 6.0 rises to the challenge—and dethrones a champ.

PC/Computing's usability testing is a departure from the more common way of reviewing products, in which a single expert renders an opinion. Our process scientifically determines how useful, powerful, and easy to learn the products are, with replicable results that are statistically sound. The chances are nine in ten that our tests will find 75 percent of the most common usability problems in any product. Testers spend about five hours testing each product according to a script. We also ask testers to rate their satisfaction level with each product. Our usability rating is based half on tester satisfaction and half on problems that surface.

Test scripts are developed by our staff usability experts after extensive research. We recruit small groups of testers, chosen through rigorous screening to reflect our readership. They are typically skilled workers who use desktop computers at their jobs. Criteria include experience with PCs and the product category, and impartiality toward the specific products in the test. The testers are not *PC/Computing* employees, but they are paid for their time. Some quotes from our usability testers appear below.

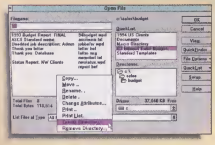
WORDPERFECT HIGHLIGHTS

Charting new usability territory.

PCComputing USABILITY APPROVED

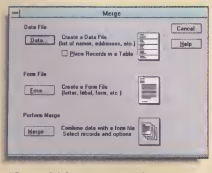
SCORE: 88

It still has the same look as earlier versions of WordPerfect, but Version 6.0 for Windows has usability enhancements nestled throughout.



"The program's Create Directory option is great."

It's a snap to manage your entire hard disk or network with WordPerfect's full-featured file manager.



"It was fairly easy to complete the merge task by following the options."

The improved mail merge guides you through each step.

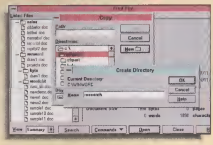
MICROSOFT WORD HIGHLIGHTS

A notch behind the new usability champ.

PCComputing USABILITY APPROVED

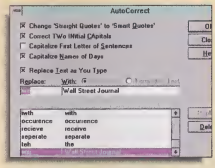
SCORE: 82

Microsoft Word—the pioneer of usability—fell short mostly in file management. Users also had some difficulty with mail merge.



"I didn't know I had to exit to create a subdirectory."

You don't! But if you don't dig deeply in Word's Find File dialog boxes, you won't find this hidden gem.



"No lags—software kept up with my typing."

AutoCorrect follows one step behind you and fixes preconfigured typos while you keep typing.

USABILITY

You need to get your work done quickly and easily. You've got no time to waste learning how to use tricky features.

Times have changed. It used to be that few people were comfortable using the words WordPerfect 5.2 and usability in the same sentence. Not so with WordPerfect 6.0. While it was a tough battle between Word 6.0 and WordPerfect 6.0 in our Usability Labs, WordPerfect took top honors and dethroned the previous champ.

The final scores in our usability tests were 88 for WordPerfect, and 82 for Word. And both products earned our Usability Seal of Approval. So where did the differences surface? More often than not, testers gave WordPerfect the edge for productivity and intuitiveness.

Specifically, file management was an area where Word couldn't compare to WordPerfect. When we asked users to create a new subdirectory in which to save a file, several Word users gave up in frustration. One user said that in WordPerfect, "Creating a new subdirectory was straightforward and easy," while another user said of Word, "The hardest thing of all was to create a subdirectory."

WordPerfect's mail merge, a task at which the previous version of the program failed miserably, was met with a new level of user satisfaction. In fact, two Word users failed to complete this task, while all WordPerfect 6.0 users were successful. One user called WordPerfect's mail merge "too easy!" Word's mail-merge process is slick, but in Version 6.0, Word has departed from its previous graphical guide through the merge task. One Word user noted that the "merge process was simple but lacks the graphical presence of Version 2.0c."

The products fared equally in our other usability tasks. Word held a slight edge over WordPerfect when it came to table manipulation—users found it quite simple to import spreadsheet data and format a table in Word.

One last usability issue to remember when you're deciding between these two products: If you come from a Word or WordPerfect background, that will affect your transition. There are very different design philosophies behind these products, and sticking with what you already know does shorten the learning curve. The usability differences our testers uncovered pointed clearly to WordPerfect as the winner, but they were subtle differences. Feature for feature, either of these two outstanding products will serve you well.

	Verdict
☑ **WordPerfect 6.0 for Windows**	**88**
☐ Microsoft Word 6.0 for Windows	82

Circle 117 on reader service card.

SIMPLE DOCUMENTS

Creating the easiest documents takes up most of your time. Let your word processor take care of those memos.

You know the routine: You wake up, shower, eat breakfast, go to work, and write memos and business letters all day long—or so it seems. If an automated workday appeals to you, take a close look at Microsoft Word 6.0.

Word takes care of the tedium—so you can worry about what's really important. Consider the product's AutoFormat feature, for example. This automatic facelifter will turn your boring text documents into eye-catching finished products in a matter of seconds.

Or look into LetterWizard in Word 6.0, which goes way beyond formatting and dives into content. That's right—content! There are 15 prewritten typical business letters ranging from credit report requests to résumé cover letters. The Wizards prompt you for the necessary sending information and plop it into your document where it belongs. Word 6.0 has 38 templates, and Wizards are available for 10. But you can't preview templates without taking a trip to the Style Gallery, where you can view a template as a sample or applied to your own document.

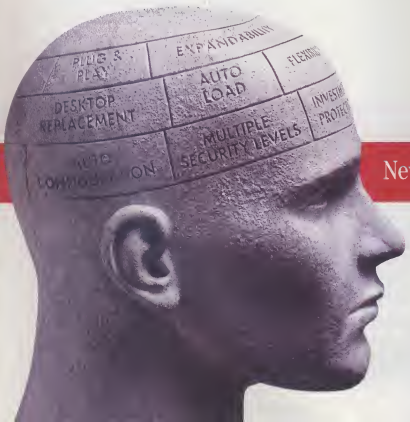
WordPerfect also offers automation through its ExpressDocs templates, which are available for memos, letters, and even presentation slides. There are 72 templates in all. As you load each template, a macro called AutoFill prompts you for necessary information, such as the recipients and subject of a memo. The drawbacks? The AutoFill macro isn't exactly quick, and when you preview ExpressDocs, you can't see the formatting.

Basic editing tasks are a snap in each product. If you repeatedly make the same typos, Word's AutoCorrect feature will have you dancing at your workstation. Just configure AutoCorrect to fix the mistakes you make most, like typing "iwth" instead of "with," and you'll save yourself precious seconds here and there.

The right-mouse button will become your new best friend. And the more you rely on it, the more you'll appreciate WordPerfect's context-sensitive implementation of right-mouse–button menus. The major drawback in WordPerfect, however, is that you cannot customize the right-mouse–button shortcut menus as you can in Word.

Overall, Word 6.0 does double-duty for your simple-document needs by automating tedious tasks intelligently. Now if only it would return your phone calls.

		Verdict
✓	**Microsoft Word 6.0 for Windows**	**91**
	WordPerfect 6.0 for Windows	85



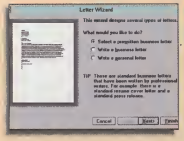
New Intelligent Docking: So smart it k

intel inside

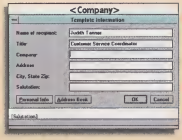
SNEAK A PEEK AT SIMPLE DOCUMENTS

Automated templates take care of the tricky stuff.

Both Microsoft Word and WordPerfect offer predesigned document templates that make creating good-looking documents a snap. Word even goes so far as to offer prewritten typical business letters.



Microsoft Word
Word's LetterWizard takes care of all the details for you—including providing standard prewritten business letters for 15 comman scenorios.



WordPerfect
The ExpressDocs templotes use the AutoFill macro, which prompts you to enter pertinent information for your document.

Microsoft Word
The LetterWizord then shows you the formotted result. You can provide same information in the Wizord, and the rest within the document.

WordPerfect
After you fill in your information, WordPerfect places it directly into the templote. All thot's left for you is to type the letter.

An industry first from Texas Instruments: Automatic load and system configuration.

We call it the ultimate desktop replacement. You'll call it remarkable. It's our new TravelMate™ Intelligent Docking System*. And by listening to the needs of notebook users, we've created the industry's most advanced docking system available. It's also the most complete.

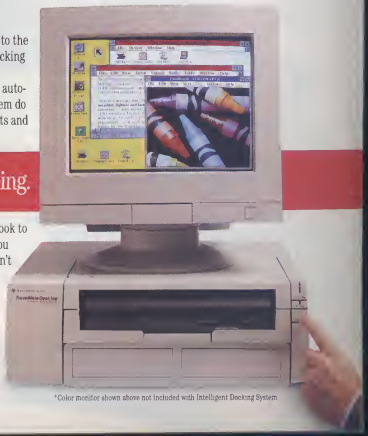
Just insert any TI TravelMate 4000E notebook computer into the auto-loading mechanism, push a button, sit back and watch the docking system do the rest. Expansion is a snap too, with six ISA and two PCMCIA card slots and four drive bays.

nows if your TI notebook is coming or going.

Our Intelligent Docking System makes the transition from notebook to desktop replacement fast and easy. When you dock, it knows whether you have an external monitor, keyboard or internal modem. Meaning you don't have to reconfigure each time you insert your TravelMate. When you're ready to hit the road, simply click an icon and the system knows to save the file you're working on, close Windows™ and eject your TravelMate. Then away you go. That's true desktop replacement. From the one notebook company who listens.

TEXAS INSTRUMENTS

Circle 118 on reader service card.



*Color monitor shown above not included with Intelligent Docking System

COMPLEX DOCUMENTS

These products are designed to be pushed to the limit. Throw your company newsletter at them. They can take it.

You may not be a professional publisher, but you want your word processor to make people think you are.

Whether you're producing your company newsletter or putting together a quarterly sales report, neither of these products will let you down. Both contain templates for highly formatted documents like newsletters or reports.

If you're putting a lot of bulleted or numbered lists in your document, Microsoft Word will be your pick, if only because it's faster and more user-friendly than WordPerfect. Modifying elements of a bulleted and numbered list—such as the position on the page or the distance between a bullet and text—is quick and easy.

What's the most common element in a complex document? A table, of course. And both products have made it simple to plop one into your text. However, WordPerfect's right-mouse-button menus give you more options within a table than Word's. If you do any math in your tables, WordPerfect will stand by you—all of the power from the PlanPerfect spreadsheet is in your word processor.

When you're creating complex documents, you'll undoubtedly be taking full advantage of the power of styles. With Version 6.0, Word has added character styles and made it easier to create style sheets and modify templates. With WordPerfect it's easy to create styles based on examples, but defining styles from scratch can get tricky.

Word pioneered usable mail merge. And WordPerfect 5.2 for Windows' dismal merge capabilities won't be missed. However, in Version 6.0, WordPerfect has enhanced its mail-merge facility so dramatically that our usability testers gave it the nod over Word's.

One welcome new feature is known as Format Painter in Word, and as QuickFormat in WordPerfect. The original idea first showed up in Lotus Ami Pro 3.0—remember FastFormat? Just highlight the formatting you want to apply elsewhere in your document, and apply the same formatting to other areas with a click of the mouse. WordPerfect's implementation of this feature is ultrasmooth.

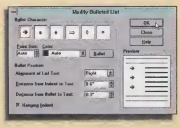
When you're doing a major overhaul of your document, you want to be in WordPerfect. The power it offers for long, complex documents is staggering—and the usability ain't too shabby, either.

	Verdict
WordPerfect 6.0 for Windows	91
Microsoft Word 6.0 for Windows	89

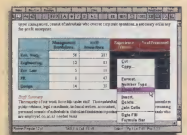
FORMATTING FREE-FOR-ALL

Your documents have never looked so good.

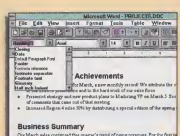
It hasn't always been this easy. These top-notch products go out of their way to make complex-document creation a breeze. Check out the templates. Point here, click there, and voilà—you have a masterpiece.



Microsoft Word
Make your bullets look just right with Word's easy-to-use dialog box, which provides visual cues as you manipulate your options.



WordPerfect
The table function packs in the power for formatting and calculating. The right-mouse support makes table manipulation and editing a breeze.



Microsoft Word
Applying styles doesn't get any easier than this—just pull down the list straight from the toolbar, choose your preferred style, and get the look you're after.

WordPerfect
Version 6.0 has templates for complex documents, such as newsletters. Just give it the information it asks for and you're halfway there.

The most comprehensive line of 486 notebooks designed specifically to meet your needs.

When it comes to listening to your notebook computer needs, at Texas Instruments we hear what you're saying. And it shows in our line of TravelMate 4000E Series notebooks. After all, we offer a wide range of 486-based notebooks plus an Intelligent Docking System with your needs in mind.

You'll find the entire high-performance lineup, from our economical monochrome WinSX/25™ to our active matrix color WinDX2/50™ powerhouse, is ideal for portable and desktop replacement needs. The critics agree. To start with, Texas Instruments notebooks are the only products in any category ever to win five *PC Magazine* Editor's Choice Awards all in a single issue.* And that's just the beginning.

But, there's really only one way you can find out if a TravelMate 4000E is right for you. Try one!

We're delivering.

TRAVELMATE 4000E SERIES NOTEBOOKS

DISPLAY	PROCESSOR	MEMORY†	PRICE††
Active Matrix Color	486DX2-50MHz	4MB RAM/200MB HDD	$3,999
Dual Scan Color	486DX2-50MHz	4MB RAM/200MB HDD	$3,499
Color	486DX2-40MHz	4MB RAM/200MB HDD	$2,899
Color	486SX-25MHz	4MB RAM/120MB HDD	$2,249
Monochrome	486DX2-50MHz	4MB RAM/200MB HDD	$2,899
Monochrome	486SX-25MHz	4MB RAM/120MB HDD	$1,899

TRAVELMATE INTELLIGENT DOCKING SYSTEM

COMPATIBILITY	EXPANSION	INTERFACES	PRICE††
TI TRA4000E Series Notebooks	Six 16-bit ISA slots, two PCMCIA Type III slots, four drive bays	Parallel/2 Serial, VGA, Mouse, keyboard and game ports, RJ-11 jack	$849

† RAM expandable to 20MB with optional memory †† Estimated street price. Dealer prices may vary

* The Editor's Choice Awards in August 1993 issue of *PC Magazine*
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Then decide if indeed we have been listening. Learning. And delivering. Simply call **1-800-527-3500** to find the TravelMate dealer nearest you.

EXTENDING YOUR REACH WITH INNOVATION™

TEXAS INSTRUMENTS

Circle 119 on reader service card.

CUSTOMIZATION

Like building the perfect house, time and imagination will let you configure the word processor of your dreams.

You know the story: "I want it how I want it." You spend too much time in your word processor not to have it tailored to fit your needs. Fortunately, that's not demanding too much these days.

Probably the first things you'll rush to personalize are your toolbars. And there are enough toolbars in both of these word processors to keep you customizing indefinitely. Not only do both products have toolbars for a variety of functions, but designing your own toolbars is a breeze as well. You can plant icons for menu commands on your toolbars, and assign files, macros, and even other applications to icons for quick and easy access. If you want to design your own icons for macros or other features, you'll find a bitmap editor to satisfy your artistic cravings. Once again, WordPerfect's bitmap editor is more powerful and easier to use than Word's.

But don't stop at the toolbars. You can dive right in and be your own usability developer by designing the menus just the way you like them. Overall, menu customization in Word is just how it ought to be: simple, simple, simple. Just jump to the menu customization dialog box, highlight the items you want to add or delete, and go for it. This works for top-level menus and the right-mouse–button shortcut menus. Menu customization is a bit tricky to find in WordPerfect, and once you get there, figuring out just how to do things isn't always intuitive. Once you get the knack, however, you'll be coming up with extremely useful menus.

Of course, what would customization be without automation and macros? If you're recording macros as you work, the sky's the limit. But if you want to write or edit your own, you'll wish you majored in computer science after all. Both applications have an extremely powerful macro language, but it's definitely not for beginners. If you have grand plans for taking advantage of the dialog editors, steer clear of WordPerfect's. You'd never guess you were creating graphical elements for all the words you have to go through to get there.

Both of these programs take customization to the limit—and they do it gracefully. Word wins the prize, however, for easier and more powerful menu customization and for a dialog editor that is a bit friendlier.

		Verdict
☑	**Microsoft Word 6.0 for Windows**	**85**
☐	WordPerfect 6.0 for Windows	81

SOUNDMAN® WAVE: GENUINELY BETTER SOUND, FULLY LOADED.

Maybe you've read* how wavetable synthesis uses actual recordings of instruments to create synthesized sounds. And how fantastic it sounds versus regular FM synthesis. Well it's true. SoundMan Wave lets gamers rock and roll with the real thing for an affordable price. And it comes loaded with great software like MCS MusicRack™, BeSTspeech™, and ReadOut™.

COMPLETE COMPATIBILITY GUARANTEE.

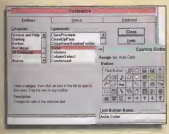
SoundMan Wave's Yamaha OPL4 chip is completely compatible with the AdLib/Sound Blaster standard so it is backed by a 100% money-back compatibility guarantee, and we'll give $500 to the first

GUARANTEED 100% ADLIB/SOUND BLASTER COMPATIBLE

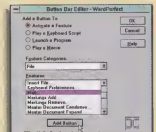
A CLOSER LOOK AT CUSTOMIZATION

Personalize your word processor to fit like a glove.

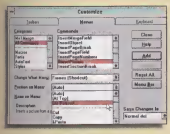
If the tools in your word processor oren't exactly where you wont them—chonge them! With just a few clicks of the mouse, edit your toolbars ond menus. It's eosy to spend a few minutes designing your own interfoce.



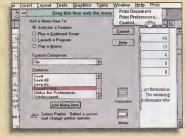
Microsoft Word
Customize your toolbars by choosing o commond or macro ond ossigning it to o predefined icon or to one you've creoted yourself.



WordPerfect
Version 6.0 lets you choose from oll ovoilable functions to ossign new buttons to your toolbar. As in Word, you con olso ossign mocros to icons.



Microsoft Word
From the some diolog bax, you con design menus (both top-level ond shortcut) to show the feotures you wont, right where you wont them.



WordPerfect
Customizing menus in WordPerfect isn't quite os intuitive os it is in Word, but it is simple to drog new items to existing menus or to ones you creote.

YOU'VE HEARD US TOOT OUR HORN.

WAVE TABLE TECHNOLOGY OF SOUNDMAN WAVE

DON'T BELIEVE US? CALL NOW FOR OUR FREE *SOUND ADVICE* AUDIO CD AND GET A $10 REBATE.

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*See PC Magazine 12/31/94 p.165
**® - ® - ® - ® - ® - ® - ® - ®

premium that comes across a game with which doesn't fully Sound Blaster compatible. Right now, hot games like X-wing, 7th Guest, Doom and Space Quest 5 already take full advantage of our wave technology. Dozens more are expected to hit the market each month.

LOGITECH
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Circle 141 on reader service card.

PERFORMANCE

It doesn't take a type A personality to demand stellar performance—the last thing you need is to hurry up and wait.

Face it. It's just not cool to arrive at a business meeting fashionably late. You and all your colleagues have to have it done yesterday. That means no time to dillydally around waiting for documents to print, or to find and replace every mention of that client's name you misspelled in the 50-page proposal. So which word processor will keep you punctual? That depends on what you do most.

"It's printing" is one of the best procrastination excuses there is. But it won't win you any awards in the deadline department. What's more important to you: having that document in your hand, or getting back to work as soon as you've pressed that print icon? If it's the former, better choose Microsoft Word. Word will have your document complete and in the printer tray in almost nothing flat. If you rely on WordPerfect, make sure you're using WordPerfect's dedicated printer drivers, and your documents will be printed just a few seconds behind Word. If resuming work at your computer is what you value most, you'll be amazed at how quickly Word returns control to the user because of its background printing capabilities. It's so fast, in fact, you'll wonder if you really did push that print icon.

And what about that misspelled client's name? Here's where WordPerfect qualifies as a superior time-saver. In our tests, it was 36 percent faster when replacing a word used 5,422 times in a 55-page document.

If you save your files as often as you should, you'll be able to spend more time working on your document with WordPerfect. Word lagged significantly behind WordPerfect at saving a file—and this time can add up.

Scrolling is something we can never seem to get enough of. You keep thinking, "I know that paragraph is in here somewhere." Well, which product you choose will depend on just how you like to scroll. Are you a down-arrow person, or a scroll-bar person? The down-arrow folks will lean toward WordPerfect for the sake of sheer speed: It was 65 percent faster than Word. But with all of that speed, you can't see what's happening when you're scrolling—so why bother? Granted, Word plods along, but it does so at a methodical pace that lets you scan as you go. On the other hand, if you're a scroll-bar-with-mouse type, Word will get you there about 30 percent faster than WordPerfect.

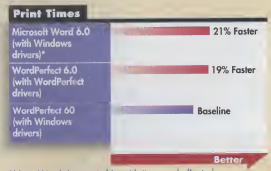
What's the bottom line? Word and WordPerfect were neck and neck in almost all of our performance tests. But in the tasks you'll be using most, Word makes up the difference. If you've got the need for speed, get Word.

		Verdict
✓	**Microsoft Word 6.0 for Windows**	**89**
	WordPerfect 6.0 for Windows	82

TRACKING THE TIMES

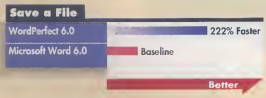
The less time for coffee breaks, the better.

Neither word processor is head and shoulders faster than the other. But if you look closely, you'll uncover differences in significant areas. Overall, Word performed a bit better than WordPerfect.

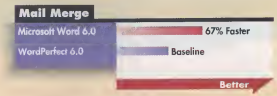


*Note: Word does not ship with its own dedicated print drivers.

Printing times are nearly equal—provided that you use WordPerfect with its own printer drivers.



Opening files is almost a toss-up, but if you do a lot of saving, WordPerfect will save time.



Word's quick mail merge will have those huge weekly mailings done in a jiffy.

THE EASIEST-TO-USE WINDOWS SPREADSHEET

"Quattro Pro—that's like being offered a Lexus for the price of a Hyundai."

—*Los Angeles Times*, September 23, 1993

Experts say Quattro Pro is better than 1-2-3 and Excel

New Quattro® Pro 5.0 for only $49.95? Isn't this the spreadsheet that just outscored 1-2-3 in performance, ease of learning and use, and quality of output and presentations, in *PC Week's* critical "First Look" review? Isn't this the spreadsheet that just revolutionized ease of use with Spreadsheet Notebooks, Interactive Tutors, and Experts™? Isn't this the spreadsheet that *PC Computing* just voted Most Valuable Product in the spreadsheet category? And that just won *PC Magazine*'s Editor's Choice award?

Yes. Yes! YES!

"This program is *hot*!"
—*InfoWorld*, Nov. 1993

Well, why on earth is Borland virtually *giving* it away? The answer is simple. We want to make you an offer so irresistible, you'll rush out to see today's hottest spreadsheet.

Breakthrough technology you have to see to believe

InfoWorld says, "several innovations give Quattro Pro a leg up on the current version of Excel." Interactive Tutors teach new users how to perform common tasks. Experts walk you through advanced analytical procedures, chart creation, scenario management, and worksheet consolidation. There are new @functions, new Intelligent Graphs, new ways to analyze your data graphically, and easier ways to manage scenarios. The Database Desktop™ unlocks the doors to external databases, and the Data Modeling desktop outperforms Lotus Improv. Plus the new Workgroup Edition builds in full support for SQL servers and lets you share worksheets with others over networks and E-mail.*

Now is the perfect time to take the world's best spreadsheet for a spin. Test-drive Quattro Pro today. Available in award-winning DOS, Windows, and special Workgroup editions.

Award-winning selection!

DOS | Windows | Workgroup Edition Upgrade

90-day, money-back guarantee!
See your dealer or call now, 1-800-336-6464, ext. 7902
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*Supported communication transports: Novell Message Handling Service (MHS and NGM), MCI Mail; cc:Mail (vendor-independent messaging); Windows for Workgroups, MS-Mail, and other MAPI-compliant messaging services; Local Area Network (LAN) systems, such as Novell NetWare, Banyan, IBM® LAN Server, MS-LAN Manager, AT&T StarGROUP, and other peer-to-peer networks. Offers good in the United States and Canada only. All prices in U.S. dollars. Dealer prices may vary. Copyright © 1993 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. Quattro Pro for Windows and Spreadsheet Notebooks have patents pending. BI 6294-1

Circle 125 on reader service card.

DOCUMENT MANAGEMENT

Managing files can be a full-time job. Sit back and let your word processor sweat those little details.

In our quest for the paperless office, we keep mounds of documents on our systems and networks—those that we work on every day, and those we access maybe once a month. Is it possible for your word processor to ease the burden of document management and retrieval, both on a single machine and on a network? If you're using WordPerfect 6.0, it sure is.

One of the standout features in WordPerfect is its amazingly powerful file manager. In fact, you can kiss the Windows File Manager good-bye and rely on WordPerfect's for all of your needs. Our favorite part of WordPerfect's amazing file manager: QuickLists. These are highly descriptive names you can assign to directories and subdirectories. Choose to have your QuickList always showing and you'll never have to remember another directory name again. Oh, and don't worry. You can choose to attribute long filenames to individual files as well as directories.

WordPerfect offers all of the other basic file management features, including capabilities for creating and removing directories; deleting, moving, renaming, or copying files; sorting files by various attributes; and previewing files before opening them.

Word's file management is woeful compared with WordPerfect's. There are options to search for lost files, and you can preview a file's contents, but the implementation is less than user-friendly. You'll find basic document management capabilities, but there are few beyond simple commands such as print, copy, delete, or sort. Word has finally added the capability to create a directory from the file manager, but it's less than easy to find.

Both programs offer e-mail integration features that let you send documents and route them via a defined series of users through e-mail systems. Both products support all VIM and MAPI-compliant e-mail systems.

For network support, you'll find the usual file sharing precautions in each product. If a file is currently in use and someone else tries to access it, the second person will be able to open a read-only version, and will have to save changes under a different filename.

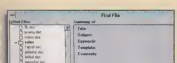
WordPerfect is clearly the best product for people who manage many documents over networks and other platforms. The file management features can't be beat, and few dedicated file managers come close.

		Verdict
✓	**WordPerfect 6.0 for Windows**	**91**
	Microsoft Word 6.0 for Windows	80

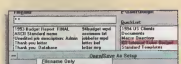
CONTROLLING THE CHAOS

It's a word processor and a file manager.

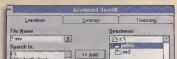
Your word processor needs to work double-time making sure you can find your documents when you need them. And WordPerfect adds a host of other document management functions just to make your life a little easier.



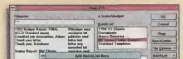
Microsoft Word
File management options are slim in Word 6.0, offering only basic functions. You'll have to rely on Windows File Manager for complex actions.



WordPerfect
Version 6.0 gives you various options for the display of your file manager, including preferences about how to display listed files.



Microsoft Word
When you're trying to find a lost file, you'll have to navigate through a tricky dialog box and provide clues for a lost file's directory location.



WordPerfect
Using customized QuickLists, you can easily manage numerous levels of directories and subdirectories with extended names.

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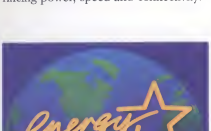

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INTEGRATION

The best word processor is the one that operates in perfect harmony with the rest of your office's applications.

You don't work in a vacuum, and neither does your word processor. It's called upon to integrate with other applications—be it importing or exporting files, trading documents among users, or getting that spreadsheet chart with this quarter's results into your semiannual report.

WordPerfect offers the most friendly communication highway with your other applications. There is support for a wide range of file formats, such as those for word processing (including Ami Pro, a format that Microsoft Word doesn't support), graphics, and even database programs.

Integration with Borland products is also strong, offering support for OBEX—Borland's Object Exchange technology, which provides publish and subscribe capabilities across various e-mail systems—as a subscriber.

If your company does a lot of cross-platform document sharing, WordPerfect stands out with versions for DOS, Windows, OS/2, Macintosh, Unix, Digital Equipment Corp. VAX/VMS, Data General systems, and others.

The applets integrated in WordPerfect are accessible and easy to use. The new TextArt applet lets you create designer text elements, complete with shadows, text following various shapes, and numerous fill patterns. You'll also find a powerful equation editor and a drawing module chock-full of ease-of-use touches.

Word 6.0 has taken a giant step with support for OLE 2.0, which you won't find in WordPerfect until later this year. OLE 2.0 lets you drag and drop elements (an Excel 5.0 chart, for example) directly from one application to another. Double-click on the element in the source or container document (most likely Word in this example), and you'll have all of the features of Excel 5.0 for Windows available from within Word—menus and all. The big problem with OLE 2.0 at this point: Few vendors have implemented it.

Word also supports a wide range of word processing, graphics, and data formats, but the list isn't as lengthy as WordPerfect's. You'll also find that the integration with Word's applets is kludgy compared with that of WordPerfect.

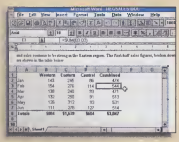
While Word is ahead of the game in offering support for OLE 2.0, the benefits won't all be there until other applications support it. The bottom line on integration is still support for other applications, and WordPerfect has Word beat by a nose.

	Verdict
WordPerfect 6.0 for Windows	**88**
Microsoft Word 6.0 for Windows	84

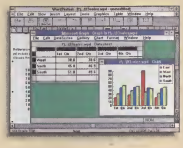
WORKING WITH OTHERS

Integration with other applications is paramount.

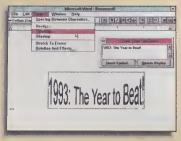
More often than not, your word processor provides the document within which you incorporate information from various sources. Communicating with other word processors and application categories is the key to increased productivity.



Microsoft Word
Through OLE 2.0, if you're editing on Excel 5.0 chart from within Word, your menus and toolbars change to give you all of Excel's functions.



WordPerfect
If you edit an embedded worksheet in WordPerfect through OLE 1.0, you'll launch Excel, edit, then exit and resume work in WordPerfect.



Microsoft Word
Implemented via OLE 2.0, you'll see WordArt's menus while you're in Word, but the applet isn't as easy to use as WordPerfect's.

WordPerfect
TextArt, the text effects applet in WordPerfect that is accessible via OLE 1.0, is easier to use and provides more visual feedback than Word's WordArt.

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THE BASICS

Easy to use or not, you'll still need a nudge to keep rolling. Choose the product with the best support.

It may seem easy enough to sit down, start typing, and produce a masterpiece with a word processor. But the truth is, these are complex applications with tons of little features nestled all about. Fortunately, both Microsoft Word and WordPerfect have gone to great lengths to give you all sorts of learning aids. Word has the edge, offering innovative twists on traditional help.

The Wizards in Word 6.0 are ready to wave their magic wands over your documents as you create them. You'll find ten Wizards for document templates that ask you some necessary questions about the style you want your document to assume, then fill in some information for you and turn you loose.

Word also lets you start your day off right with the Tip of the Day feature—a dialog box that pops up with a helpful hint each time you launch Word. There are 268 tips in all, covering topics from all areas of the product.

You'll find sufficient online help in Word 6.0. The printed documentation is well-organized and contains a special Quick Start section at the beginning of each chapter, which gives you a condensed version of how to accomplish any task. If you need more support than the program can provide, Microsoft offers free, but not toll-free, technical support from 6 a.m. to 6 p.m., Pacific time, Monday through Friday.

WordPerfect 6.0 for Windows provides 12 Coaches to explain various processes. When it comes to performing a task, Coaches encourage you to stand on your own. Your Coaches will teach you more about features such as graphics, headers and footers, borders, and more.

WordPerfect also provides an online tutorial, in addition to an extensive 33-lesson teaching aid with an accompanying workbook. WordPerfect's written documentation still follows an alphabetical format (as opposed to Word's feature- or task-oriented approach), but there are now more cross-references to make sure you find what you need.

WordPerfect offers toll-free tech support from 7 a.m. to 6 p.m., as well as free, but not toll-free, support from 6 p.m. to 11 p.m., mountain time, Monday through Friday.

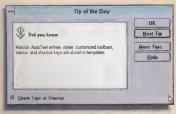
Even if you're a word processing guru, you'll need some assistance if you want to get the most out of Word or WordPerfect. Of the two, Word's approach to help and instruction stands out.

	Verdict
Microsoft Word 6.0 for Windows	91
WordPerfect 6.0 for Windows	85

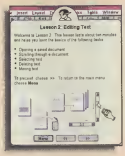
HELP IS THERE WHEN YOU NEED IT

Your word processor gives you the guidance you need.

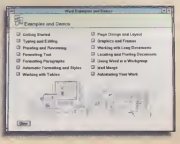
You can't be expected to remember every little feature in your word processor. That's why you'll find interactive help and tutors ready to come to your aid should you get a little lost.



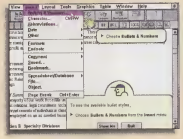
Microsoft Word
Every time you launch Word, you can receive a tip that gives you information about features or shortcuts to accomplish basic everyday tasks.



WordPerfect
The online tutorial in WordPerfect is more basic than Word's and offers information only about simple word processing tasks.



Microsoft Word
The online tutorial consists of Examples and Demos, which provide how-to information about using numerous features within Word.



WordPerfect
From within your own working document, you can call on Coaches, which provide assistance and tips about how to use various features.

PC/COMPUTING SCORECARD

The differences lie more in personal preferences than in overall scores.

FACTOR	Microsoft Word 6.0 for Windows	WordPerfect 6.0 for Windows
Usability (25%)	82 A solid product that falls short of the new champ in ease of use.	88 WordPerfect makes tough tasks oh-so-easy.
Simple documents (20%)	91 Great templates and Wizards for quick-and-easy documents.	85 Not as many ease-of-use touches here as in Word 6.0.
Complex documents (15%)	89 Powerful features, but just a notch below WordPerfect's.	91 Creating complex, highly formatted documents is nearly automatic.
Customization (5%)	85 It's a breeze to set up toolbars, menus, and macros to your liking.	81 You'll have to be persistent if you want to get your menus configured just so.
Performance (10%)	89 Quick for printing and mail-merge tasks.	82 Excels at everyday file operations, such as opening and saving.
Document management (10%)	80 Woeful file manager by WordPerfect standards, but e-mail and network strengths keep Word in the game.	91 File manager is so powerful you can use it in place of Windows'.
Integration (5%)	84 Power of OLE 2.0; stellar integration with other Microsoft applications.	88 Supports Borland's OBEX standard; excellent cross-platform availability.
The basics (10%)	91 Wizards everywhere! Online and printed documentation give you all the help you'll need.	85 Coaches serve up interactive help. Availability of tech support is tops.
TOTAL SCORE	86.5	87.1

FUTURE WORLDS OF WORD PROCESSING

Automation will answer the call for more features.

Where do we go from here? We have a word processor that corrects typos and formats documents for you. And another that sports an even better file manager than Windows itself. Name a feature you truly need, and Microsoft Word or WordPerfect probably has it. So how will these software giants keep developing upgrades that are worth our attention?

Easy. The next steps are super-sophisticated automation, integration, and power. In Word 6.0, Microsoft has only scratched the surface of automated word processing. Word's AutoFormat feature is truly amazing, but you can't rely on prebuilt formats to work perfectly yet. In upcoming versions, chances are we'll find more accurate guesswork underlying such features. AutoCorrect takes a step toward making typos a thing of the past. But we all make so many unusual typos in one day that we can't possibly enter them all into Word's AutoCorrect dialog box and still expect to get our work done. What if two words run together? In the future, you can expect this feature to work more intelligently, and probably in closer cohoots with your document dictionary.

But the slickest automated features will be the ones that do the truly hard work for us—compose our typical memos, or help us come up with ideas and outlines for our work. And watch for voice-activated menu controls, and even typing, in future word processors.

WordPerfect 6.0 reflects a great deal of effort to work out usability kinks and implement innovative features. In Version 6.0, WordPerfect serves up all the features present in PlanPerfect, WordPerfect's now-defunct spreadsheet. And WordPerfect is stocked with ultimate graphics power. With an everything-but-the-kitchen-sink word processor, who needs spreadsheets or graphics packages? You'll also probably find some more automation features reminiscent of the latest version of Word.

Lost but not least, look for seamless and powerful integration from future versions of both Word and WordPerfect. OLE 2.0 is just the beginning of things to come—and WordPerfect will jump on that bandwagon sometime this year. When Chicago—the next version of Windows—arrives, we may see a new world of seamless application integration unfold before us (see "Inside Windows 4.0," page 124).

Keep your eyes peeled for Lotus's Ami Pro 4.0, which should arrive later this year and could provide some leaps in word processing technology. In the meantime, you can bet that neither Microsoft nor WordPerfect will rest on its laurels. Too much is at stake.

Biff! Whap! Socko! Two Fanatics Slug it Out

PC/Computing *Senior Contributing Editor Ron White and contributor Scot Finnie, each armed with ten years of experience with their respective word processors (see reviews in November and December 1993 issues of* PC/Computing*), battle it out to prove which is the mightier of the two word processors: Microsoft Word 6.0 for Windows or WordPerfect 6.0 for Windows.*

THEY'RE MORE THAN THE SUM OF THEIR PARTS

SCOT: Word has been so widely improved in Version 6.0 that when you're talking about the usability improvements, you might as well just scratch Word 2.0, and forget it ever existed. Word 6.0 offers a host of usability features, too numerous to count and not hugely significant on their own. But taken collectively they add up to a major new word processor.

RON: The operative phrase here is "not hugely significant."

SCOT: OK, no more mister nice guy. You want powerful features? How about AutoFormat, AutoCorrect, AutoSelect, AutoText, Undo/Redo, AutoCaption, tunneling dialogs, single-row tab dialogs, and improvements to features like Drop Caps, envelopes, bullets, and numbering?

RON: You're just throwing in every new feature, most of which are in WordPerfect 6.0 anyway, and calling it a usability improvement. One bell-and-whistle feature in Word 6.0 I do think is cool is AutoCorrect. But while Word's way is more whizzy, WordPerfect accomplishes the same thing with automatic, no-questions-asked correction of common typos when you run the spell checker. But I'll give Word credit for making it easier to add a word to its AutoCorrect feature on the fly.

SCOT: Call it whizzy if you want, but what's cool about AutoCorrect is that you can use it to insert special characters automatically. Try that in WordPerfect.

RON: Word's way of doing it on the fly is slicker, but I wouldn't base my choice of a word processor on it. As for Word's other gee-whiz feature, AutoFormat, I'm undecided. I was impressed at first, but then I started comparing the formatting with the contents of the file. Some of the formatting was appropriate, some wasn't. It's a good idea, but we haven't yet reached the point where we can trust our software completely.

SCOT: This is one feature you just have to use a bit to get the hang of. No matter how you look at it, this is an extremely powerful feature that's deceptively easy to use. The hardest part about AutoFormat is understanding what it does, so you can get the best out of it.

RON: This could be a good feature, but I worry about the insidious nature of it.

SCOT: Branding it as evil isn't going to change the essential fact that AutoFormat is so cool and powerful that it's going to take time for people to get the hang of. Once they do, though—look out, WordPerfect!

RON: You call this a great usability feature, and at the same time you say "it's going to take time for people to get the hang of." Sounds pretty oxymoronic to me.

SCOT: Nope, I didn't call AutoFormat a usability feature. In fact, AutoFormat is the biggest all-new feature in Word. No other word processor has it, and let's face it, they're all going to add it. Especially WordPerfect!

PHOTOGRAPH BY PAM FRANCIS

RON: I'll admit Word has some really dandy individual features. But there's a design philosophy in the program as a whole that really rankles me. The File, Open dialog is at the root of my dislike for Word. It has a Nazi attitude that it knows better than you about

how you ought to use your word processor. An almost trivial example—trivial except for how irritating it is—is the way that Word tries to force you to use the .DOC extension for all files it creates. Word automatically shows you only *.DOC files. You have to change it to *.* in each session.

SCOT: Nazis, huh? Don't you think you're being a little paranoid? On the face of it, I agree with you about the .DOC extension thing in the File, Open dialog. And we've criticized Word 6.0 for that in the past. One thing it did do to help out those who use other extensions is place the "All Files *.*" setting at the very top of the list of file types in the File, Open box, so you don't have to scroll around to find it.

PHOTOGRAPH BY JUIE CHASE

SOUPED-UP FILE MANAGEMENT

RON: Oh, but for a contrast in how much respect a word processor can have for its users, just step this way and take a look at how WordPerfect 6.0 for Windows handles files. Not only does it not force you into some unnatural use of an extension, but it provides a way to give a document long, descriptive, mixed-case names. You tell me which you'd rather pick out of a long list of files: "Changes to Bill's 1994 budget" or "BBUDCH94.DOC"?

SCOT: All of this is great, but bottom line: We need a file system that supports long filenames—which we're going to get in the next version of Windows.

RON: Fine. You wait for the next version of Windows. Meanwhile, I have long filenames and you don't. The File dialog boxes in WordPerfect for Windows are both powerful and friendly enough that no one should ever have to use the dreaded Windows File Manager again. What would take a dozen or more clicks in Word is reduced to a double-click of a directory with a long, descriptive name in WordPerfect's QuickList. And you know, it wouldn't entirely surprise me if the next generation of Windows—Chicago or Cairo or Cucamonga or whatever it's called now—does have these basic file-handling features just so Microsoft can save some face.

SCOT: Microsoft has quietly said that file management functions will be available in common dialogs of future versions of all its applications. And, yes, it's a strong likelihood that they mean that Windows 4.0 (I think you can remember that name, Ron) will have these functions built right in to its common dialogs. Now, wouldn't that be a far better way to approach all this?

RON: You keep talking about how good Word will be in the future. Let's talk here and now—like one of WordPerfect's best features—the Quick Menus activated by pressing the right-mouse button. Word has the same thing, except that Word has only a few basic menus that it applies to all situations. WordPerfect's QuickMenus pop up with different options depending on where the cursor is at the time you click the right button.

SCOT: Because Word has a nearly perfect present, and its future is visible—and cool—it's worth talking about both. It's true, right-mouse–button pop-up menus aren't as well implemented in Word 6.0 as I'd have liked. One thing Word does have that would make it easier for me to cozy up to WordPerfect is the ability to let you customize its pop-ups with your own menu items.

RON: *Sigh.* I agree. This is one area where WordPerfect, which is usually one of the most customizable programs around, dropped the ball.

IT'S ALL A MATTER OF TASTE

RON: I'll admit, AutoCorrect—and maybe AutoFormat—are nice ideas, but I'll bet you dinner at our favorite, most expensive French restaurant that in its next version, WordPerfect will have two of the three bells and whistles, but Word won't have a better way to handle files.

SCOT: If we're talking the next major revs of both products, I'll take that bet! Wow . . . Duck Rounnais! Waiter, please bring him the check.

RON: And I'll up the ante with a bottle of 1947 Chateau Cheval Blanc Bordeaux!

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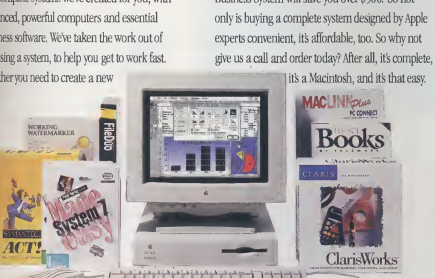

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Apple

DSP: The Secret Is Out!

Digital signal processors give you more power, more features, more choices—at lower prices.

BY JOHN BRYAN

ALMOST IN THE blink of an eye, a PC revolution took place. There were no monster headlines. Nobody threw a victory party. The DSP revolution happened quietly.

A digital signal processor (DSP) is a simple thing. It's just a programmable processor that—unlike a general-purpose processor such as a 486—is dedicated to one type of processing but not limited to a single data type. A CPU is asked to process all kinds of data in a variety of ways. But a DSP repeats the same data process again and again. For example, it can be programmed for the sole purpose of processing sound files. But what's really revolutionary about DSPs is that they don't need to be harnessed for a single task, but can do double or triple duty. Especially for multimedia applications—which require massive sound and video files to be processed in one big rush—DSPs are a godsend.

DSPs were first used in PCs more than five years ago when Next Computer implemented them in its workstations. Since then, Analog Devices, AT&T, Motorola, and Texas Instruments have been fighting tooth and nail over DSP PC standards. Each has its own agenda. AT&T, Motorola, and Texas Instruments are promoting proprietary technologies, while Analog Devices is pushing for an open architecture. But amidst this nasty standards war that's keeping PC users from getting great products at great prices, a breakthrough of sorts has been made, clinching the DSP revolution. Microsoft is developing a Windows application program interface (API) that works with any DSP. Now software developers looking to optimize their products to capitalize on the raw computing power of DSPs just need to write to Microsoft's API.

So who wins, and how? You do. Thanks to DSPs, you will get fuller-featured PC products at much lower prices. You'll also be able to upgrade your system's capabilities at dirt-cheap prices—and with hardly any effort. Imagine getting extra processing horsepower for sound, video, and modem transmissions all from a single programmable processor on one cheap board in your PC. Your multimedia apps will fly. Imagine not having to go out and buy a new piece of hardware when you want to upgrade your modem. Instead, you'll be able to upgrade to a new, faster transmission speed just by running a quick software program.

From convenience to cost savings, the DSP revolution is a big win for all of us.

But what exactly is a DSP? Basically, it's a fully programmable processor, just like a 486. But DSPs are applied only to specific tasks, and they process data in a different way than general-purpose processors (see "How a Digital Signal Processor Works" page 189). General-purpose CPUs simply aren't up to the task of work-

PHOTOGRAPHS BY HENRIK KAM

ing with the audio and video data at the heart of today's multimedia applications. But add a DSP to the mix, and your PC no longer chokes on the megabytes of files that deliver ear-popping sound effects or full-motion video to your desktop. That's possible thanks to the DSP's ability to compress and decompress data.

And multimedia isn't the only game in town. DSPs pick up the processing slack in a myriad of applications, including data and voice modems, voice recognition, data compression, medical imaging, and even video conferencing.

PROCESSING POWERHOUSES

What does a DSP have that a CPU doesn't? Nothing, really. After all, DSPs don't run at a faster clock rate than conventional processors, and there isn't anything inherently faster in the silicon. In fact, a CPU can handle every calculation a DSP can (and many it can't), just as it can do the same calculations it offloads to a math coprocessor. But like math chips, DSPs handle these operations much faster.

How much faster depends upon the DSP. For example, the Texas Instruments TMS320C25 is a commonly used 16-bit DSP that delivers three to five times the performance of a 386. That's because a CPU spends the lion's share of its time moving bits from one place to another, or from one register to the next, while a DSP concentrates on pure multiplication to pump data through. An integrated or external I/O controller feeds this data stream to the DSP.

This ability to move data onto and off of the chip quickly is the key to DSP design. To this end, its architecture differs from a CPU in several ways, including the addition of multiple memory buses, specialized data-access ports, accessible cache architecture, and data addressing optimized for DSP calculations. Arguably the most important of these is the use of multiple buses. With one bus for instructions and another for data, the DSP can handle the "multiply and accumulate" algorithm in a single instruction. Some DSPs go one better and have two parallel data buses for increased speed.

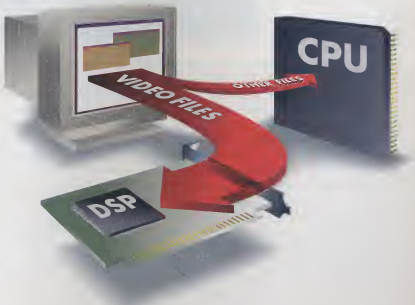
The cache on a DSP also plays a vital role. Caches are based on a phenomenon known as the *locality principle*. A CPU that executes instructions sequentially (a von Neumann CPU) tends to access the same memory

HOW A DIGITAL SIGNAL PROCESSOR WORKS

Turn your PC into a multimedia screamer by going with a DSP.

Bringing multimedia to your PC is easy, but living with the consequences isn't always. After all, full-motion video and CD-quality sound translate into megabytes of files for your PC to process. But pop a DSP into your system and it takes over all of the work from the CPU.

PC WITHOUT A DSP: The CPU relies on a built-in command set to deal with a variety of instructions and data types, of which video is just one. The video data drains the CPU's resources, making it unavailable to process other data.



PC WITH A DSP: A DSP handles multimedia files more efficiently than a CPU because it is dedicated to a single processing task. The DSP tackles the video file, freeing the CPU to process other data, such as a spreadsheet file. The DSP is not limited to just video processing, but can also be programmed to process other types of data, like sound.

locations repeatedly. That's why a CPU dedicates a large area to an internal cache. But a DSP doesn't work this way. Instead of executing a series of instructions, it repeats the same instruction on a varying stream of data. A small, programmable data cache provides a buffer for this data stream. As DSPs move into the mainstream and program complexity increases, however, this design is changing. Larger onboard caches for both instructions and data are being used to give DSPs more flexibility in their application.

DON'T FIX IT

Given the processing potential of DSPs, it's no wonder they will have significant impact on PC products. But the funny thing is that DSPs are not a new PC innovation. In fact, every modem or sound card in existence has a DSP at its core. What has changed is that the DSP is no longer relegated to a single processing task or *fixed function*.

Programmable DSPs mean that your PC or add-in board can take on a new task with just a software upgrade. For example, what you thought was an ordinary sound card can become a fax modem, telephone answering machine, and video-compression engine—all in one. This is a concept many in the industry are calling *virtual hardware*, because what was formerly a sole hardware function is being replaced by software.

What makes this flexibility possible are compression/decompression algorithms, or *codecs*. These software modules are like small programs that tell the DSP how to compress and process the incoming data. Codecs have varying compression rates that depend on the type of information being compressed and the DSP being used.

You'll recognize the names of many common DSP codecs: ADPCM, MPEG, QSound, and DVI, for example. Expect to hear more new terms as the widespread use of DSPs ushers in new codecs and DSP applications.

The processors driving this industry come from only a handful of manufacturers, the primary companies being Analog Devices, AT&T, Motorola, and Texas Instruments. Of these, Analog Devices is probably the industry leader in DSP technology, while Texas Instruments sells more volume, primarily in low-end DSPs, than all the others combined. A new player entering this race is Media Vision, which has licensed core DSP technology from Analog Devices and will soon be selling its own chips in addition to DSP-based sound boards.

STANDARDS STANDOFF

With all of these chip makers attempting to get their DSPs into PC products, the competition is fierce. And Microsoft's announcement that it will develop a standard API will sustain the competition. Working with Microsoft in this endeavor is Spectron Microsystems. Its Spox operating system supports all major DSPs, except AT&T's. Spox rests in a DSP's memory and controls what the chip does—loading a new codec, for example.

The Interactive Multimedia Association—which includes representatives from Apple, AT&T, IBM, Microsoft, and Spectron—is taking an even broader approach in an attempt to establish DSP standards. It is an API that will work with any DSP, host CPU, and operating system (including OS/2 and System 7). In the meantime, IBM, Texas Instruments, and Intermetrics, a software-development company, are promoting a proprietary standard called Mwave. The Mwave processor is designed for multimedia applications like JPEG image compression, voice recognition, data and fax communications, echo cancellation, music, and text-to-speech conversion. The Mwave Manager provides an API for device drivers written for either OS/2 or Windows. Mwave is garnering the support of major software developers, including Microsoft, Borland, Lotus, and WordPerfect. While IBM will use Mwave processors in its own products, Texas Instruments is developing an OEM channel of distribution for the Mwave product.

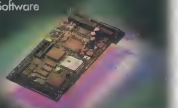
Analog Devices is also working with a variety of technology firms to promote its Signal Computing Initiative (SCI), a framework encompassing all aspects of the integration of DSP technology into PCs. While Analog Devices will supply a chip set consisting of a DSP and appropriate front-end technology, the API is open to other vendors.

One company that supports the SCI framework is Aox, whose role is to provide standardized modules to OEMs—both hardware and software—to facilitate the development of DSP applications. For example, it

MODEM

DSP application: Data, voice, and fax processing.

DSP advantage: Software upgradability ensures that it won't become obsolete, enabling users to get the latest modem technology for a minimum investment.



Pictured: Digicom's Connection 14.4+ Fax.

Price: $199.

Description: A 14,400-bps fax and data modem that will be software upgradable to V.32terbo, V.Fast, send/receive Class 2 fax, voice messaging, and other future communications standards.

offers codecs, chip sets, and reference designs (master designs that companies can build to).

Aox and its OEM partners strive to get maximum use of a single piece of hardware. The OEM cost of raw materials for a fax modem card, sound card, or graphics processing card is around $100 each, so replacing these with a $50 DSP solution makes a lot of sense.

AT&T is the only DSP manufacturer that has produced its own DSP operating system. The Visible Caching Operating System (VCOS) is a multitasking operating system that resides in the DSP's local memory. Combined with AT&T's Visible Caching Application Server (VCAS), the operating system helps developers integrate AT&T DSPs into their products. VCOS and VCAS are also part of Apple's Advanced Real-Time Architecture (ARTA) standard.

ARTA is a real-time multitasking and multiprocessing signal-processing extension for the AT&T DSP featured in the Macintosh Centris 660av and Quadra 840av. Apple uses the DSP to enable full-motion, full-screen display, capture, and output; CD-quality sound; and speech synthesis and recognition.

HERE AND NOW

There's no doubt that better, cheaper PC products are on the way, but what can you buy right now to take advantage of DSP technology? Getting a sound card or modem is the easiest way to take the DSP plunge. But you can also get your hands on notebooks, video boards, and even hard drives. See *PC/Computing*'s "DSP Resource Guide" on page 196 for more DSP products.

System vendors including Apple, Hewlett-Packard, IBM, and Olivetti use DSPs on their motherboards or in add-in boards to support sound, fax modems, or graphics functions.

Tim Bajarin, president of Creative Strategies, a high-tech consulting firm, expects DSPs to become standard on PC motherboards. "Only if the DSP is integrated into the motherboard will multimedia system prices come down to under $1,000. Last year's multimedia PC, with CD-ROM and sound card and communications, cost $2,500-plus, while this year the same system will be under $2,000, perhaps as low as $1,750. Next year's could be under $1,000 if all of these features are integrated into the motherboard."

Modems were one of the first available applications of programmable DSPs. And it's here that you can really see a DSP's versatility. Data transmission and fax standards like V.42 and Class 3 are constantly being replaced by newer, more powerful standards. Instead of being stuck with a modem that's two or three generations behind, you can bring a modem with a programmable DSP up to snuff with a simple software upgrade.

A perfect example of this flexibility is seen in the Connection line of modems from Digicom Systems. These are not hardware modems in the traditional sense. Instead, they are RAM-based DSP boards with a telephone line interface. For purchasers of last year's Connection 96+, the first in the series, Digicom has since offered software upgrades that boost its performance to 14,400-bps data and fax capabilities.

National Semiconductor's TyIn2000 offers a similar solution. This $169 add-in board supports business audio, as well as data and fax transmission. You can take advantage of all three functions by adding voice annotation to any fax or modem transmission. Or set up the board to act as a digital voice-mail system with automatic compression on saved files. The onboard DSP, National's own 32-bit processor, allows for three levels of fax compression, including the Modified, Modified Read (MMR) international fax standard set by the CCITT, previously found only on standalone fax machines.

Most of the DSP-based modems available today provide voice capabilities, along with data and fax. But there's no need for manufacturers to stop there. Take Digicom's $299.99 Sound Connection, which is being marketed as a 16-bit sound board but has modem and fax capabilities as well. Future upgrade plans include MPEG and JPEG compression, and even color fax technology.

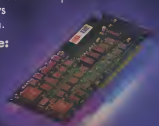
A SOUND INVESTMENT

Sound card manufacturers are one group that has been quick to adopt DSPs as the new standard. DSPs bring processing power, compression algorithms, and sound effects to PC audio. The DSP first made its debut on a sound card in Turtle Beach's $599 MultiSound. Already

PHOTOSHOP ACCELERATOR

DSP application: PhotoShop for Windows acceleration.

DSP advantage: Speeds up time-intensive PhotoShop tasks by taking over processing from the CPU.



Pictured: Storm Technology's PhotoDSP 400.

Price: $399.

Description: An add-in board for PhotoShop for Windows image-processing acceleration, which uses two DSPs to speed up tasks such as Image Size, Rotate, Gaussian Blur, Feather, Despeckle, and Sharpen Edges by as much as ten times.

considered state of the art for its high-quality wave-table synthesis, the MultiSound truly was ahead of the curve. But now other manufacturers are catching up.

Cardinal Technologies is one sound-board maker that has made the DSP transition, and it is already offering upgrades that take advantage of it. Cardinal uses Analog Devices' Personal Sound Architecture chip set in the $229 Digital Sound Pro 16 Plus. This 16-bit FM synthesis card has a $59 wave-table synthesis upgrade and a $79 MPEG audio-compression feature called XingSound from Xing Technologies. XingSound works with any sound board based on an Analog Devices DSP. On the horizon from Cardinal is a voice-recognition upgrade.

DSP Solutions, as the name implies, is another pioneer in the development of DSP sound technology for PCs. The $198.95 Port-Able Sound Plus is a self-powered DSP sound system that uses a Texas Instruments DSP and plugs into the parallel port on a portable or desktop system. It includes standard sound-card functions, a text-to-speech conversion utility, and speakers. Its pass-through design lets you attach a printer to the same parallel port. DSP Solutions also offers a PCMCIA version of the product called the Port-Able Sound PCMCIA.

Creative Labs—whose Sound Blaster products dominate the PC sound card market—has also realized the benefits of DSP. The company has introduced an optional proprietary DSP for its latest sound cards, the $299.95 Sound Blaster 16 MultiCD and $329.95 Sound Blaster SCSI-2 ASP sound boards. This DSP is designed specifically for audio effects and codec support of any attached storage devices. Among the effects offered by Creative Labs is QSound Virtual Audio, which produces 180-degree Surround Sound effects.

PHOTOSHOP AT LIGHTNING SPEEDS

Add-in boards that speed up Adobe PhotoShop are a common product in the Macintosh market. Now, thanks to Storm Technology, that same performance boost is finally available to Windows users. Like Storm's Mac boards, the PhotoDSP boards accelerate PhotoShop tasks like "motion blur" and "sharpen edges." These tasks are extremely processor intensive, so they respond minimally, if at all, to traditional Windows accelerator products, which speed up only basic drawing commands.

PhotoDSP 400 provides a solution to this dilemma by using dual AT&T DSPs to offload processing tasks from the CPU, and deliver up to ten times the speed of an unenhanced system. And Storm's PhotoDSP 400 is remarkably inexpensive at $399. PhotoDSP 800 ($899) is the same hardware bundled with Adobe's PhotoShop for Windows.

Would you believe that DSPs will even help make better hard drives? Quantum has put them to work in a read technology called Partial Response Maximum Likelihood (PRML). This digital process replaces the analog process called *peak detection* used in many drives. The bottom line is faster transfer rates, improved seek times, and higher data integrity. Quantum's Empire line of hard drives currently uses PRML, and Quantum has plans to expand its use throughout all of its drives.

While a single DSP has the power to take on many jobs, imagine what you can do with a bunch of them working together. Giga Operations is a startup firm that has developed a low-cost, massively parallel DSP board. The Visual Computing Module board has four DSPs, 4MB of RAM, and three programmable gate arrays (PGAs). All of this processing power allows the board to deliver 40 million instructions per second (MIPS). A similar board with eight DSPs, the G-200, revs throughput to 160 MIPS, roughly eight times the processing power of a 486.

The result is a "soft machine," a system that can reconfigure itself in real time (on the order of 10 milliseconds) to be whatever the software tells it to be. Giga Operations is also developing its own C compiler, which optimizes functions for such parallel operation. And it is working on a "C syntax" programming language for the PGAs on the G-200. Use of this language will allow the G-200 to apply processor resources wherever they are most effective, either enabling several parallel operations or applying the power of all the DSPs to a single function.

While several vendors have come out with integrated fax-modem products and sound cards, the next wave of modem technology is the integration of voice capabilities into standard fax-modem products. This is a necessary

SOUND CARD

DSP application: Sound, music, and voice processing.

DSP advantage: Improved sound file processing as a result of the DSP's compression ability. Software upgradability ensures that the card won't become obsolete, which allows users to get the latest sound technology for a minimum investment.

Pictured: Cardinal Digital Sound Pro 16 Plus.

Price: $229.

Description: A 16-bit FM synthesis card with upgradable features, including wave-table synthesis, voice recognition, and MPEG audio compression.

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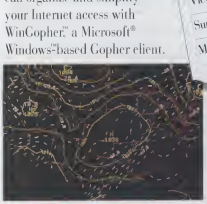
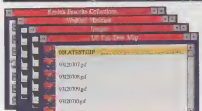
Users' Guide and Online Help	✓
Includes Text and Image Viewers	✓
Supports Windows Sound and Video Viewers	✓
Supports Phone Books	✓
Enhanced Bookmarks	✓
Views Multiple Open Servers	✓
Supports Winsock Compatible TCP/IP Stacks	✓
Microsoft Windows Interface	✓





View multiple servers at one time.

WinGopher provides you with a graphical interface that uses pull-down menus and point-and-click functionality for easy Internet navigation. Using the Gopher protocol, WinGopher supports Archie, Veronica, and WAIS searching. FTP transactions and Telnet sessions are supported, as well as any Windows sound or video viewer. An image viewer and text viewer are included with WinGopher.

Pop-up windows make searching easy.

Why WinGopher?

WinGopher is a fully supported product, including installation phone support, user documentation, online help, and an E-Mail bulletin board service. Backed by a leading automation firm, you're not left stranded should you need assistance.

Microsoft Windows Compatible

MICROSOFT WINDOWS COMPATIBLE

WinGopher works with other Windows applications and requires:

- Windows TCP/IP software and connection (Winsock 1.1 compatible)
- 386 PC or higher with Windows 3.1, DOS 5.0
- 3.5 MB disk space and 2 MB additional memory

Become a pro with WinGopher. Navigating the Internet has never been so easy.

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FAX (708) 866-4970

EMail: wingopher@notis.com

WinGopher

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NOTIS Systems, Inc. • An Ameritech Company • Evanston, IL 60201-3622

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Everything about the Crosstalk interface is designed for speed and convenience. And naturally, along with all that ease-of-use, you get the unmatched power that Crosstalk has always been known for. *PC World* wrapped up its recent review by saying, "Thanks to its clean and easy-to-use interface backed by its solid set of emulations and transfer protocols, strong scripting capabilities and remote access tools, Crosstalk easily rates a Best Buy."

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So why make it hard on yourself? Take the easy way out.

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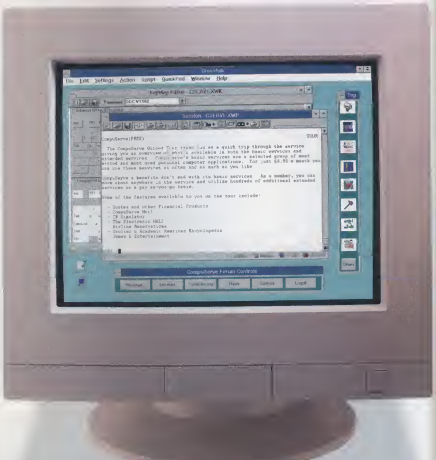

"If you like a clean, uncluttered Windows interface with some of the best-designed icons anywhere, Crosstalk won't disappoint."
— PC World *Best Buy, November 1993*

You can easily create your own customized QuickPads, or use our pre-built ones for on-line services.

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SEE US AT NETWORKS EXPO BOOTH #3109.

step in the transformation of the PC from a data-processing device to a data-communication device. Your microphone and DSP-equipped PC will dial, connect, and transmit voice, fax, and video—all on verbal command.

And you'll be able to do a whole lot more, like video conferencing. Live video teleconferencing is actually here—if you're willing to pay the price. PictureTel can bring video conferencing over telephone lines to a Windows 3.1 desktop for less than $6,000, and Sun Microsystems multimedia workstations provide the same capabilities on a TCP/IP network for less than $5,000. By early 1995, you should see this technology at prices that make it attractive for general business use.

Voice recognition is here, with software applications like Creative Labs' VoiceAssist and Covox's Voice Blaster, and hardware implementations like Compaq's Business Audio (which doesn't use a DSP). But the potential of DSPs, or DSP arrays, for voice recognition applications is much greater. You'll be able to dictate to your computer and it will create documents, correctly spelled and punctuated, then read them back to you for proofing. Companies including IBM, Verbex, and Dragon Systems are working to make this happen.

BUT WAIT: THERE'S MORE

DSPs will not only bring more powerful products, they will also make them easier to use. For example, DSP-powered modems with voice capabilities will allow technical-support organizations to help you by viewing your system display on their own systems—all while talking to you on the phone. And with the widespread adoption of system-level DSPs, software will annotate its installation and optimize its configuration by asking you what you want.

DSPs aren't just for computers, either. The military is still the primary customer of DSPs, where they are used in sonar and radar analysis. In the consumer arena, Analog Devices is testing its DSPs with several car manufacturers for use in air bags. Other automobile makers use DSP technology to provide noise suppression and generally enhance the stereo systems in their newest models. Adaptive suspension systems—first available in the Cadillac Allante, and now an option on some high-end Japanese models—also use DSPs. Finally, the automotive industry is looking at DSPs for use in an adaptive engine-firing scheme that will provide engine-knock control.

Car stereos are not the only sound systems that will benefit from DSPs. Manufacturers of audio-visual equipment are working to integrate DSPs into their products, too. The effects that can be achieved with a single, inexpensive, programmable DSP are far more comprehensive and luxurious than those from special dedicated circuitry. Dolby Laboratories, the sound-quality company, markets algorithms for audio compression to several vendors in both the audio and computing industries.

Vendors of medical-imaging applications and hardware are also taking a long look at how DSPs might enhance their products. Medical scanning is another real-time serial operation that is perfectly suited for the processing power of DSPs.

NOTEBOOK

DSP application: Sound and voice processing.

DSP advantage: Brings desktop multimedia to notebooks without adding external peripherals. Notebooks and subnotebooks without DSP on the motherboard forgo these features because they can't handle an add-in board.

Pictured: IBM ThinkPad 750C.

Price: $4,699.

Description: A 486 color notebook with DSP integrated onto the motherboard for sound and voice processing.

BEYOND STAR TREK

If it seems to you that DSPs are just about everywhere, you're right. And you'll be seeing DSPs in many more products, allowing you to get a lot more for a lot less money. So now that the secret's out and you know what kind of power a DSP can bring to your PC, you're crazy to do without. If you're in the market for a new sound card or modem, make sure you buy one with a DSP. If a new system is on your shopping list, consider one with a DSP on the motherboard, or at least on an add-in card.

Trekkies will remember the scene in *Star Trek IV,* when the U.S.S. *Enterprise* returned to modern day Earth to save the ecosystem. When Scotty was working with an engineer's computer, he interfaced with it as he would have done on the Enterprise by simply saying, "Computer?" The engineer told him to use the mouse, which he promptly picked up and spoke into, repeating, "Computer?"

This scene provided quite a few laughs because everyone knew that you couldn't talk to computers. But today, with the help of DSPs, it isn't a question of if, but when. Like a lot of science fiction authors, *Star Trek*'s writers probably weren't far off base. In fact, the joke may be on them.

John Bryan is a free-lance technology writer and consultant in San Jose, California.

PC/Computing's DSP Resource Guide

Products and services you can get your hands on now

With technology os hot os DSPs, who wonts to wait to reop the benefits? It's here now, and our guide tells you which DSP-bosed and DSP-optimized products are ripe for the picking. If you're in the morket for o modem, sound cord, or even o PC, don't settle for less thon DSP technology.

COMMUNICATIONS

Advanced Communication Enhoncement (ACE) • $259 • Best Data Products • 21800 Nordhoff, Chatsworth, CA 91311 • (800) 632-2378, (818) 773-9600
An internal board featuring 9,600-bit-per-second (bps) fax transmission, 14,400-bps data transmission, sound, telephone-answering capabilities, and a CD-ROM interface. Upgrades available include 19,200 bps and 28,800 bps.
Circle No. 723 on Reader Service Cord

14.4 Multimedio Modem by Boco • $295 internal, $345 external • Boca Research • 6413 Congress Ave., Boca Raton, FL 33487 • (800) 229-1753, (407) 997-8621
A 14,400-bps data and fax modem with integrated support for audio communications, including recording and playback of audio files for answering-machine functions.
Circle No. 724 on Reader Service Cord

The Complete Communicotor EZ • $99 internal, $129 external • Boca Research • 6413 Congress Ave., Boca Raton, FL 33487 • (800) 229-1753, (407) 997-8621
A 2,400-bps data/9,600-bps fax modem with voice capabilities.
Circle No. 725 on Reader Service Cord

Connection 14.4+ • $199.99 • Digicam Systems • 188 Topaz St., Milpitas, CA 95035 • (800) 833-8900, (408) 262-1277
A V.32bis internal modem that can be upgraded via DigiCom's BBS. Future upgrades include support for V.32terbo, V.Fast, Class 2 fax, and voice messaging.
Circle No. 726 on Reader Service Card

Fax Authority/Office • $895 • ASP Computer Products • 160 San Gabriel Dr., Sunnyvale, CA 94086 • (800) 445-6190, (408) 746-2965
A fax processor that can be directly shared by five users because it works independently of a PC. Supports Group III faxing, CCITT enhanced error-correction made, and MMR compression.
Circle No. 727 on Reader Service Cord

Multimedio Modem • $169 internal, $215 external • Boca Research • 6413 Congress Ave., Boca Raton, FL 33487 • (800) 229-1753, (407) 997-8621
A 2,400-bps data and 9,600-bps fax modem with voice capabilities.
Circle No. 728 on Reader Service Card

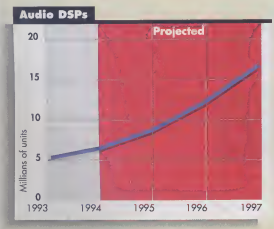
MVP144DSP • $189 • Cardinal Technologies • 1827 Freedom Rd., Lancaster, PA 17601 • (717) 293-3000
A V.32 14,400-bps fax and 14,400-bps data modem.
Circle No. 729 on Reader Service Card

Tyin2000 • $169 • National SemiConductor Corp. • P.O. Box 58090, Santa Clara, CA 95052 • (800) 272-9959, (408) 721-5020
A 9,600-bps fax and data modem with voice capabilities and three levels of fax compression.
Circle No. 730 on Reader Service Card

Ultimo Home Office • $199 • Prometheus • 9524 S.W. Tualatin Sherwood Rd., Tualatin, OR 97062 • (800) 477-3473, (503) 692-9600
A 14,400-bps combination data and fax modem with voice playback and recording capabilities. Also available in a 2,400-bps data/9,600-bps fax combination for $119.
Circle No. 731 on Reader Service Card

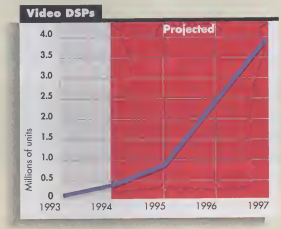
WindSurfer • $429 Microchannel, $349 ISA• IBM PC • Route 100, Bldg. 3, Somers, NY 10589 • (800) 426-2968, (914) 766-1900
A 9,600-bps fax modem with voice messaging and telephone-answering capabilities.
Circle No. 732 on Reader Service Card

Continued on page 198



Source: Forward Concepts

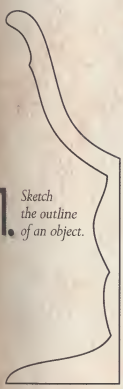
By 1997, as more DSPs ore implemented on PC motherboards, add-in sound boords ore expected to moke up only one-third of this market.



Source: Forward Concepts

DSPs applied os video codecs are just beginning to toke off, but by 1997 they should moke up obout 10 percent of the totol DSP morket.

NOW DAZZLING 3-D IS AS EASY AS...



1. *Sketch the outline of an object.*

2. *Click and "sweep" it into three dimensions.*

3. *Click again to rotate the object as desired.*

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Windows Sources
December, 1993

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Circle 253 on reader service card.

PC/Computing's DSP Resource Guide *continued from page 196*

SOUND AND VOICE

Ario 16se • $169 • Prometheus • 9524 S.W. Tualatin Sherwood Rd., Tualatin, OR 97062 • (800) 477-3473, (503) 692-9600
A 16-bit wave-table synthesis sound board with speech recognition.
Circle No. 733 on Reader Service Card

Audiovotion Adapter • $219 • IBM PC • Route 100, Bldg. 3, Somers, NY 10589 •(800) 426-2968, (914) 766-1900
A 16-bit wave-table synthesis sound board with 3-D sound.
Circle No. 734 on Reader Service Card

RAP-10/ATB • $599 • Roland Corp. • 7200 Dominion Circle, Los Angeles, CA 90040 • (213) 685-5141
A 16-bit wave-table synthesis sound board.
Circle No. 735 on Reader Service Card

AudioView • $79.95 • Voyetra Technology • 5 Odell Plazo, Yonkers, NY 10701 • (800) 233-9377, (914) 966-0600
A suite of sound programs including a digital audio editor, audio mixer, and CD controller for sound cards and multimedia PCs.
Circle No. 736 on Reader Service Card

DragonDictate 30K 2.0 • $1,995 • Dragon Systems • 320 Nevado St., Newton, MA 02160 • (617) 965-5200
Speech-to-text dictation system with a DSP to speed processing.
Circle No. 737 on Reader Service Card

Digital Sound Pro 16 Plus • $229 • Cordinol Technologies • 1827 Freedom Rd., Lancoster, PA 17601 • (717) 293-3000
A 16-bit FM synthesis sound board. Upgrades available for voice, 3-D sound effect capabilities, and MPEG audio compression. A wave-table synthesis ROM upgrade is also available.
Circle No. 738 on Reader Service Card

DSP-16 Plus • $259 • MediaMagic • Austin Computer Systems • 10300 Metric Blvd., Austin, TX 78759 • (800) 624-8654, (512) 339-3500
A 16-bit wave-table synthesis sound board. Also available without the SCSI interface and with FM synthesis for $159.
Circle No. 739 on Reader Service Card

Listen for Windows 1.1 • $495 • Verbex Voice Systems • 1090 King Georges Post Rd., Bldg. 107, Edison, NJ 08837 • (908) 225-5225
Add-in board and software for continuous speech recognition. Available in a portable parallel-port device for $1,655.
Circle No. 740 on Reader Service Card

MultiSound • $599 • Turtle Beach • P.O. Box 5074, York, PA 17405 • (800) 645-5640, (717) 767-0200
A 16-bit wave-table synthesis sound board.
Circle No. 741 on Reader Service Card

MultiSound Monterey • $399 • Turtle Beach • P.O. Box 5074, York, PA 17405 • (800) 645-5640, (717) 767-0200
A 16-bit wave-table synthesis sound board featuring special audio effects and supporting the use of a WAV file as a MIDI instrument.
Circle No. 742 on Reader Service Card

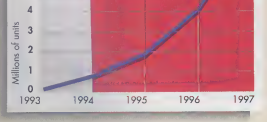
Port-Able Sound PCMCIA • $279.95 • DSP Solutions • 2464 Embarcadero Way, Palo Alto, CA 94303 • (415) 494-8086
A PCMCIA sound product with 16-bit playback, 14-bit recording, and wave-table synthesis.
Circle No. 743 on Reader Service Card

Port-Able Sound Plus • $198.95 • DSP Solutions • 2464 Embarcadero Way, Palo Alto, CA 94303 • (415) 494-8086
An external parallel-port sound device that supports 16-bit playback and 14-bit recording.
Circle No. 744 on Reader Service Card

SonicSound • $299 • Diamand Computer Systems • 1130 E. Arques Ave., Sunnyvale, CA 94086 • (408) 736-2000
A 16-bit wave-table synthesis sound board featuring QSound Virtual Audio effects. Available upgrades include speech recognition.
Circle No. 745 on Reader Service Card

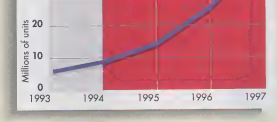
Sound Blaster 16 SCSI-2 Advanced Signal Processing • $329.95 • Creative Labs • 1901 McCarthy Blvd., Milpitas, CA 95035 • (800) 998-5227, (408) 428-6600
A 16-bit FM synthesis sound board with QSound Virtual Audio effects. Optional daughterboard available for wave-table synthesis.
Circle No. 746 on Reader Service Card

Continued on page 200



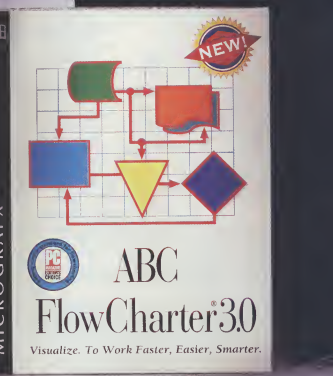
Source: Forward Concepts

Currently only 2 percent of the DSP market, multifunction DSPs are the wave of the future and are expected to grow to almost 20 percent of the market by 1997.



Source: Forward Concepts

As the DSP revolution moves into high gear, the market should continue to boom, and is projected to grow seven-fold in just five years.



There are many ways to do flowcharts. Only one was voted "best".

PC MAGAZINE EDITORS' CHOICE
December 26, 1995
ABC FlowCharter Version 3.0

Fast and easy ABC FlowCharter 3.0. The world's #1-selling, #1-rated flowcharting solution.

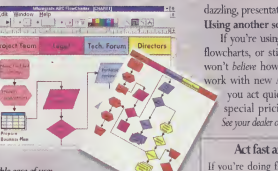
They looked at all the major products people are using to do flowcharts. Then the editors at *PC Magazine* made their choice.

The winner? Not surprisingly, it was the world's #1-selling flowcharting solution: ABC FlowCharter® from Micrografx.

Why? It's easy.

Around the world, flowcharting is helping managers track the flow of information, streamline procedures and boost quality and efficiency. But they don't have time to draw and redraw charts – or learn a complicated graphics package. And that's where ABC FlowCharter comes in.

With ABC FlowCharter 3.0, creating



Incredible ease of use: one of the many reasons PC Magazine said ABC FlowCharter has "set a new standard for flowcharting software."

great-looking flowcharts is as easy as "point and click." Just choose the shapes you want from handy shape palettes. Drop them where you want them. And let ABC FlowCharter draw in the connecting lines. Then add text, color, clip art, scanned images – even video clips. You'll be able to create dazzling, presentation-quality charts in minutes!

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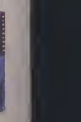

If you're doing flowcharts with another graphics package or an earlier version of ABC FlowCharter, call now to take advantage of special upgrade pricing. And for a limited time, all purchasers get a FREE copy of incredible new SnapGrafx™ (reg. $295) – the software that lets you create fabulous graphics without drawing. *Call today!*

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Available at: COMP USA • Computer City • Corporate Software • Egghead Software • Software Spectrum • Softmart • 800-Software

PC/Computing's DSP Resource Guide

continued from page 198

Sound Connection • $299.99 • Digicam Systems • 188 Topaz St., Milpitas, CA 95035 • (800) 833-8900, (408) 262-1277
A 16-bit FM synthesis sound card and 14,400-bps data and fax modem with voice capabilities. Future software upgrades include V.32terbo and answering-machine features. A ROM upgrade for wave-table synthesis is also available.
Circle No. 747 on Reader Service Card

SoundWave 32 • $299 • Orchid Technology • 45365 Northport Loop West, Fremont, CA 94538 • (800) 776-2443, (510) 683-0300
A 16-bit wave-table synthesis sound board.
Circle No. 748 on Reader Service Card

XingSound • $99.95 • Xing Technology Corp. • 1540 W. Branch St., Arroyo Grande, CA 93420 • (800) 294-6448, (805) 473-0145
MPEG audio compression software that works with sound boards based on Analog Devices DSPs.
Circle No. 749 on Reader Service Card

VIDEO

Communicator • $99 to $5,900 • Eyetel Technologies • Suite 206, 267 W. Esplanade, North Vancouver, British Columbia, Canada, V7M1A5 • (800) 736-3236, (604) 984-2522
Video-conferencing hardware and software for PCs.
Circle No. 750 on Reader Service Card

PhotoDSP 400 • $399 • Storm Technology • 1861 Landings Dr., Mountain View, CA 94043 • (415) 691-6600
A PhotoShop for Windows accelerator board that speeds up image size, rotation, Gaussian blurring, Blur More, and edge sharpening. Available bundled with PhotoShop for Windows for $899.
Circle No. 751 on Reader Service Card

PictureTel Live PCS 100 • $5,995 • PictureTel Corp. • The Tower at Northwoods, 222 Rosewood Dr., Danvers, MA 01923 • (508) 762-5000
A video-conferencing system for ISA-bus PCs.
Circle No. 752 on Reader Service Card

ReelMagic • $449 • Sigma Designs • 47900 Bayside Pkwy., Fremont, CA 94538 • (510) 770-0100
An MPEG video-capture and full-screen playback board that also features 16-bit FM synthesis.
Circle No. 753 on Reader Service Card

Source: VLSI Technology

DSP PC applications mean big business for chip vendors. The DSP market is expected to grow from about $250 million to more than $2 billion.

SYSTEMS AND STORAGE

Empire 1440 and 2160 • $1,300; $2,000 • Quantum Corp. • 500 McCarthy Blvd., Milpitas, CA 95035 • (408) 894-4000
A 1.44-gigabyte (GB) or 2GB hard drive that uses DSPs for high sustained data-transfer rates.
Circle No. 754 on Reader Service Card

IBM ThinkPad 750C • $4,699 • IBM PC • Route 100, Bldg. 3, Somers, NY 10589 • (800) 426-2968, (914) 766-1900
A 486 color subnotebook with DSP on the motherboard for sound and voice processing.
Circle No. 755 on Reader Service Card

Quoderno 33 • $1,750 • Olivetti North America • 22425 Appleway, Liberty Lake, WA 99019 • (800) 633-9909, (509) 927-5600
Subnotebook with DSP chip on the motherboard for sound and voice processing. Also available in full notebook versions and desktop systems.
Circle No. 756 on Reader Service Card

INFORMATION RESOURCES

Analog Devices DSP BBS • Analog Devices • 1 Technology Way, P.O. Box 9106, Norwood, MA 02062 • (617) 329-4700
Log in and ask questions, find out about upcoming seminars, and download application notes and data sheets.
Circle No. 757 on Reader Service Card

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—Researched and compiled by Liesl La Grange

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Unlocking TrueType

Some of the best features of TrueType for Windows (and DOS!) are things Microsoft never told you. By Brian Livingston

The world of PC printing changed forever in April 1992 when Microsoft built scalable TrueType fonts in to Windows. For the first time, Windows users could see the same fonts on their monitor that would print on their printer—without having to buy and configure a separate add-in product.

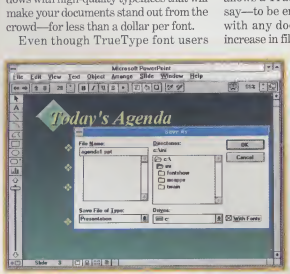
But some of the most powerful capabilities of TrueType have remained hidden, known to only a few users. In this column, I'll show you how to:

- Create documents that display and print distinctive TrueType fonts—even on PCs where those fonts have never been installed. (It's all legal!)
- Break TrueType's Windows limitation and use any TrueType font in some of your favorite DOS-only applications.
- Replace the overused fonts in Windows with high-quality typefaces that will make your documents stand out from the crowd—for less than a dollar per font.

Even though TrueType font users have fewer choices than PostScript users (there are about 2,000 commercial TrueType fonts, compared with more than 7,000 PostScript fonts), TrueType users have a bit more flexibility. That's because of a capability that Microsoft buried into TrueType, but which has remained virtually unknown to most PC users.

Getting the Best of TrueType

This feature, called *font embedding*, allows a TrueType font—Palatino, let's say—to be embedded into or "bundled" with any document with only a small increase in file size. Such a document can be opened in an application on a machine that doesn't have Palatino installed. If the application supports font embedding, it can display and print the entire document in Palatino, exactly as you originally formatted it. And in some cases, font embedding will actually install Palatino automatically into the recipient's machine. They can then modify the original document, or create as many other documents using Palatino as they like. And this doesn't violate software license agreements!



Microsoft PowerPoint 3.0 was the first application to support Saving With Fonts. This feature lets you embed certain TrueType fonts so PCs without them can display and print them properly.

This feature offers tremendous advantages to PC users. For example, you can create a slide presentation using several creative TrueType fonts or symbol sets, then send the slide viewer and your presentation document to another user. The recipient can play the slide show on another PC—without watching all your hard work convert itself into an ugly mess in Courier because they never installed the fancy fonts you used.

Even more important, you can do the same with word processing documents or spreadsheets. If you need a special font or symbol in these files, you can include it without worrying about whether the fonts are installed on the intended recipients' systems.

TrueType fonts can support any one of four embedding levels. From most to least restrictive, these levels are:

Non-embeddable fonts. These fonts cannot be embedded into documents.

Print/preview embeddable fonts. Also called "read-only," these fonts can be embedded into a document, but the recipient cannot change the document. (Changing the document would constitute unlimited use of the fonts.)

Editable embeddable fonts. Also called "read-write," these fonts *can* be edited by the recipient, allowing anyone to alter or replace the entire contents of a file.

Installable fonts. These are installed automatically by the receiving application directly into Windows, allowing editing of the document and giving the recipient a permanent license to use those fonts in any other documents.

Getting into Embed

The downside of all these embedding capabilities is that applications must support these features for you to embed

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Font Secrets

any TrueType fonts into your documents. And most Windows applications do not yet incorporate font embedding—largely because users have not known enough about this feature to demand it.

Microsoft, which you would think would be shouting from the rooftops about this TrueType advantage, has never really crowed about it to Windows users, despite the fact that Microsoft's TrueType font packs certainly do exploit this feature. All 44 fonts in the original Microsoft TrueType Font Pack (which was introduced at the same time as Windows 3.1) are installable fonts. So are all the fonts that ship with Windows 3.1. And all the fonts in Microsoft's TrueType Font Pack 2 and Hewlett-Packard Font Set (which includes the same 35 fonts that are built in to the HP LaserJet 4) are read-write embeddable.

Yet the manual that comes with the TrueType Font Pack doesn't say a word about the capability to embed these fonts into documents. Two years after TrueType's introduction, the license agreement inserted into every Font Pack box erroneously states, "This License Agreement permits you to use one copy of the enclosed Microsoft software program on a single computer." Because of this misinformation, few users have ever tried to use font embedding, and even fewer application developers have bothered to build it in to their products.

Fortunately, this is changing. Almost at the same time that Microsoft released Windows 3.1, Microsoft PowerPoint (a Windows presentation package) became the first application to include an option to Save With Fonts in its File Save As dialog box. When you check this box, all the fonts in the document are embedded in the file, and the fonts can be opened and used on any PC with PowerPoint. As of Version 3.0, however, PowerPoint embeds only installable fonts; to embed print/preview or editable fonts, you'll have to wait for a new version.

A few months ago, Microsoft Word 6.0 for Windows became the second application to offer the power of embedding. Other applications, such as Farallon Replica (a tool for creating documents that can be viewed and printed identically on any Windows 3.1 configuration), are now emerging to give users similar capabilities. Eventually, all Windows applications should support these features—but only user demand will hasten this development.

GET RID OF TIMES AND ARIAL BOREDOM

On page 208, I name the four best TrueType font packs. Each set features many excellent typefaces—amazingly, for less than $1 each. The following are my top 10 recommended fonts from those packs: five serif typefaces, four sans-serif faces, and one incredibly useful dingbats collection. I've chosen the fonts most appropriate for anyone who wants to replace Times, Arial, and Courier boredom with something more creative, yet still businesslike.

Revival
(Bitstream TrueType Fant Pack 1)
The quick brown foxes jum

Shannon
(Agfa Discovery TrueType Pack)
The quick brown foxes jum

Agfa Wile Raman
(Agfa Discovery TrueType Pack)
The quick brown foxes jump

Chantilly LH
(InfiniType Plus)
The quick brown foxes jumped

Jessica
(InfiniType Plus)
The quick brown foxes ju

Humanist
(Bitstream TrueType Fant Pack 1)
The quick brown foxes jum

Garamond Antiqua!
(Microsoft Hewlett-Packard Fant Set)
The quick brown foxes jump

Lucida Sans Typewriter
(Microsoft TrueType Fant Pack)
The quick brown foxe

Baskerville
(InfiniType Plus)
The quick brown foxes jump

Clip Art Fants (1,000+ symbols, Agfa Discovery TrueType Pack)

Doing More with DOS

In spite of all the noise about Microsoft Windows, DOS users shouldn't feel left out. Two major third-party solutions have emerged to make TrueType fonts accessible in several familiar DOS applications.

InfiniType Plus, by SoftMaker, provides additional features and is my first choice of the two packages. InfiniType

Plus provides a TrueType font-scaling engine for Microsoft Word, Microsoft Works, WordPerfect, LetterPerfect, and WordPerfect Works. It includes an excellent selection of 124 fonts, about half of which are high-quality, general-purpose text fonts (the rest are for headlines and such). Unlike vendors that create imitations of original font designs, SoftMaker has obtained crisp, first-generation font outlines directly from two of the most respected font digitizers in the world—URW of Germany and Graphitec of Switzerland.

TrueType for DOS, published by MicroLogic Software, allows you to use any of the Hewlett-Packard LaserJet drivers provided with DOS versions of Microsoft Word or WordPerfect. TrueType for DOS provides a special printer driver for non-LaserJet-compatible printers, such as ink jet printers. The package includes 34 body-copy and headline fonts (called *text* and *display* fonts, respectively) as well as two symbol fonts. All were designed by MicroLogic and imitate most of the fonts found in Adobe PostScript printers. The list price is $49.95.

Font Bargains

The original Microsoft TrueType Font Pack, released in April 1992, established a fire-sale price of about $1 per font (lots cheaper than PostScript and other fonts up to then). This low pricing has discouraged creators of high-quality PostScript fonts from marketing their font libraries in TrueType format. Instead, imitation fonts, which can be jagged, scanned-in copies of other vendors' original designs, are now widely available in TrueType format. But a few real values comprising the finest in scalable fonts have emerged. In my opinion, every Windows and DOS user of TrueType should take advantage of these bargains.

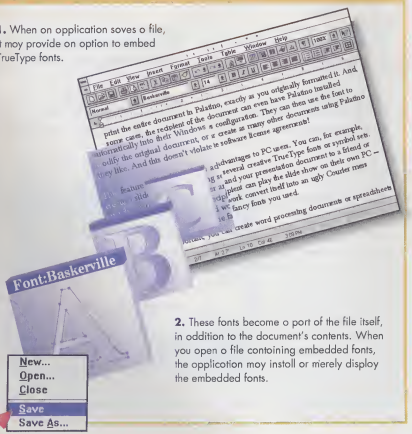
Why should you bother with more fonts? Aren't the two text choices included with Windows—Times New Roman and Arial (similar to the enduring Helvetica font found in PostScript printers)—enough for everyone?

The answer is a big NO. These core fonts in Windows have been so overused by Windows and Macintosh users that they look staid and boring. Documents that have an appealing use of fonts stand out visually. Attractive fonts can give your correspondence and proposals an edge when placed side-by-side with those of your competitors.

You could do worse, appearance wise, than to follow Livingston's First Law of Fonts: *Never use Times or Arial for anything, ever.* Of course, every rule has its exceptions. For example, if you have to exactly match the look of an older document, you may be compelled to use one of the old standbys. But in most other situations, a better choice exists. In my own Windows configuration, I've changed the default font in all my word processing templates to something more interesting than Times—and you can, too.

HOW TRUETYPE FONTS EMBED

1. When on application saves a file, it may provide an option to embed TrueType fonts.



2. These fonts become a part of the file itself, in addition to the document's contents. When you open a file containing embedded fonts, the application may install or merely display the embedded fonts.

The Best TrueType Font Packs

To help you cut through the clutter of mediocre font offerings, I evaluated all the TrueType font packs I could find for less than $100 each. I considered only those font packs that provide a range of fonts that a business could use to completely replace Times New Roman and Arial in all its documents. I further limited the field to packs that include full font families: normal, italic, bold, and bold italic. I put aside font packs that contained only novelty and headline styles.

In the distant past (before PostScript), I managed two typesetting businesses and worked with the pickiest font buyers of all—advertising-agency art directors—which gives me some qualifications for type selection. But whether or not you know anything about type, I believe you can improve your documents' appearance substantially by using one or more of the top rated font packs described here. Most of the fonts in these packs are print/preview embeddable, which means you'll be able to use them with upcoming applications that will support this capability. (For samples of my ten favorite replacements for Times and Arial, see "Get Rid of Times

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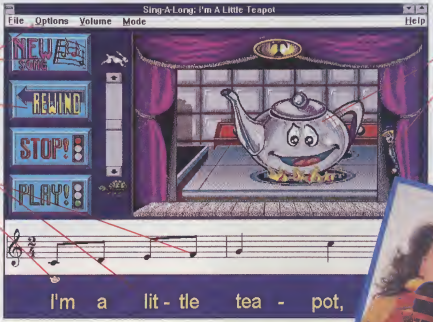

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PCC394

and Arial Boredom," page 205.) In order from highest value to merely excellent value, my font pack choices are:

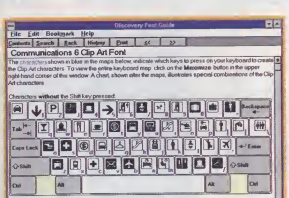
1. Bitstream TrueType Font Pack 1. This package, which includes the classic but distinctive Revival family, includes 40 of the highest-quality fonts originally digitized by Bitstream in PostScript format. Half of these are text fonts. The rest are display fonts that are all eminently useful for headline material (unlike many packs in which the display fonts are so cutesy or unusual as to be worthless). Bitstream's product lists for $39, but I've seen it offered at one discount retail store (Software Etc.) for as low as $14.99. You can't go wrong.

2. Agfa Discovery TrueType Pack. Agfa is a major type designer in the United States and Europe, and its font pack includes 46 fonts. The package not only contains the graceful Shannon and Agfa Wile Roman families but it also has 1,000 TrueType clip-art images that can be enlarged smoothly to any size. This pack gives you a wealth of symbols—computer devices, map pictographs, and many other dingbats—unmatched by any other. You should really buy and use both the Bitstream and Agfa packs. Agfa's offering ranked a very close second simply because it's priced higher, at $79 list.

3. InfiniType Plus. This collection of 124 typefaces is outstanding, even if you never use the TrueType-in-DOS capabilities of the package, which I described earlier. The font pack contains the highly useful Jessica and Chantilly families. If you tire of these fonts, SoftMaker also publishes 100 additional high-quality fonts in InfiniType Volumes 1 & 2, two collections that are now sold as a single package.

4. Microsoft Hewlett-Packard Font Set. This font pack gives you the Garamond Antiqua family—my favorite implementation of this classic and much-imitated typeface—licensed by Microsoft from Agfa. (The PostScript world suffers at least 15 reinterpretations of Garamond, from 9 foundries.) The Hewlett-Packard Font Set includes, in genuine TrueType format, all 35 fonts found in HP LaserJet 4 printers (which differ from the 35 base fonts in PostScript printers). For LaserJet 4 owners, this pack provides onscreen fonts that exactly match printouts, without purchasing an add-on utility. For LaserJet II or III owners, this font pack provides all 35 scalable fonts—there's no need to invest in a printer hardware upgrade.

You may also want to check out the original Microsoft TrueType Font Pack to get Lucida Sans Typewriter, a better-looking monospace font than Courier, and the proportional version, Lucida Sans. (This one is the best font I know for printing respectable 6-point type on a laser printer.) But you can pass on Microsoft's TrueType Font Pack 2; it's mostly odd display fonts of little use. A timeless book-publishing font, Centaur, is included but—horror of horrors—without italic or bold.



The Agfa Discovery TrueType Pack provides more than 1,000 clip-art images to augment WingDings. It includes the Discovery Font Guide, which explains how to use type effectively.

Life Beyond Font Packs

If I've convinced you to explore the boundaries of TrueType, you may find yourself wanting to use a wide selection of type, just like publishing pros. If so, you may benefit from two unique resources:

Font Connection is a utility that allows you to download any of more than 1,500 brand-name fonts from a 24-hour BBS. The utility package costs only $19.95 plus shipping. Once you have it up and running, you can view screen shots of any font in the collection, and download them via modem for a fee of $5 or more per font. Buying the Font Connection package also entitles you to download 31 selected fonts without charge, including Bitstream Charter, a font family that is designed to print well on 300-dots-per-inch laser printers.

The Precision Type Reference Guide is arguably the world's most complete guide to fonts available in the PostScript Type 1 format. For those who use Adobe Type Manager, this 250-page book ($6.95 plus shipping, credited toward your first order) is invaluable. It's heavily illustrated with font samples and it features the latest in PostScript typefaces: CD-ROMs containing thousands of fonts from leading foundries.

I hope, with all these choices, you find exactly the font you need to express your personality. Hunting through today's selection of fonts is almost as much fun as finally choosing your favorite!

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Brian Livingston is the author of *Windows 3.1 Secrets* and *More Windows 3.1 Secrets* (IDG Books).

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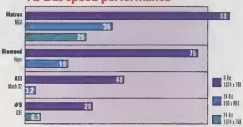

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Windows' Invisible Wall: The 64K Barrier

System resources are the hidden memory limit that Microsoft forgot.

Two steps forward, one step back. Windows shattered DOS's 640K barrier. But as soon as it broke through that brick wall, Microsoft stopped and built a brand new one, consisting of two puny 64K blocks of RAM. Called *heaps*, these cramped spaces are where Windows keeps track of essential system resources—everything from windows and menus to boxes and bitmaps. When Windows runs out of room in either of these heaps, you and your applications run out of luck. Screen redraws take forever. Chunks of dialog boxes and warning messages disappear. Windows sends out wildly inappropriate error messages like signal flares. Windows 3.1 handles resources many times better than Windows 3.0 did, but the sad truth remains: Today, your ability to run multiple Windows applications is constrained by an amount of RAM that would have seemed puny on the first IBM PC more than ten years ago.

If you haven't crashed into the 64K barrier yet, just wait. It's more of a problem now than ever before because today's applications are much, much bigger and today's PCs are more powerful than ever before. Two years ago, on a 20MHz 386 with an 80MB hard drive and 4MB of RAM, you probably would have run out of RAM long before you hit the resource ceiling. On a 486 with 16MB of RAM and a 50MB swap file, the reverse is true. Sooner or later—much sooner if you use more than one graphics-intensive application at a time—you'll experience the unpleasant effects of running low on system resources.

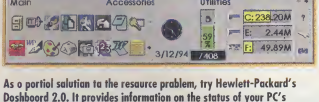
Although we can't make all of your system resource problems go away, we can help you sidestep the nastiest surprises. For starters, you need to understand what system resources are, how Windows manages them, and which (sometimes painful) choices you need to make to eliminate resource problems.

Know Your Enemy

Open Program Manager and click on Help, About Program Manager. At the bottom of the resulting info box, just below the line telling you how much memory you have left, look for System Resources: followed by a percentage. That number measures how far you are from Windows hell. If it's over 50 percent, you have nothing to worry about. Below 30 percent, you should feel your temperature rising. Below 20 percent, you're staring right into the flames.

Technically, Windows has four heaps, but the two that count most are the ones named after their two masters, GDI.EXE and USER.EXE. Windows calculates free system resources by measuring the unused capacity in the GDI and USER heaps. The Help About box in Program Manager displays the lower of those two numbers. For example, if USER.EXE has 50 percent free heap space and GDI.EXE has 70 percent free heap space, Program Manager reports 50 percent.

So, what's in these heaps? The Windows graphics engine, GDI.EXE, uses its heap to keep pointers to fonts, bitmaps, pens, brushes, palettes, and other graphical objects. USER.EXE, the piece of the system that displays and manages windows, uses its heap to track icons, title bars, window frames, and the like. When an application creates a resource, GDI.EXE and USER.EXE allocate memory for it in the heap. It's the application's responsibility to let GDI.EXE and USER.EXE know when that resource is no longer needed so they can clear the heap space. If there's no Delete call to match the Create call for a GDI object, or if the programmers forgot to follow a CreateWindow call with a DestroyWindow call, you run out of resources.



As a partial solution to the resource problem, try Hewlett-Packard's Dashboard 2.0. It provides information on the status of your PC's resources—and it uses fewer resources than Program Manager.

Eaten Alive

Some applications simply use lots of resources. Others forget to clean up after themselves. In either case, you're at the mercy of programmers' skill and sensitivity. Faced with sluggish performance, some applications might preload fonts or bitmaps to avoid having to hit the hard drive later. And some developers are just, well . . . sloppy.

The roster of applications that eat resources is long. Micrografx's Designer 3.1 and Software Publishing's Superbase 1.3, for example, consumed resources faster than a starving student at a buffet

WIN APP OF THE MONTH

Clipboard Extender

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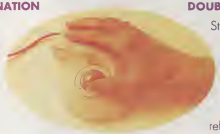

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table. Upgrades or patches fixed the problem for both applications, however. Toasters flew away with precious system resources in Berkeley Systems' After Dark Version 2.0; fortunately, there's an easy fix in the form of a new .DLL file.

These are hardly the only resource leakers in the Windows world, however. Graphics-intensive applications in general and screen savers in particular are known leakers. Of course, when you suffer a General Protection Fault (GPF), your application won't get a chance to clean up after itself, and Windows is likely to lose track of resources. You'll just have to reboot.

Some of the most aggressive consumers of Windows resources aren't applications at all, in the strictest sense of the word. Video drivers, especially those which provide Windows with 256 colors or more, can cause baffling resource problems. That's because these drivers typically create palettes of 20 colors and swap them in and out of memory. If the developer is careless, it's easy to lose track of a palette. The result? System resources slowly dwindle.

And then there's Windows itself. You may start a Windows session with more than 80 percent free resources. But as time goes on, that amount will shrink, stabilizing to as low as 70 percent. The problem arises as you begin to use Windows components, and there's really nothing you can do to minimize it.

The Fix?

In Windows 3.1, you're most likely to run out of system resources when the GDI.EXE heap becomes overstuffed with buttons, dials, and other graphical objects. You'll experience a low system resources error, even if the other heaps are relatively empty. Closing Windows applications frees most USER.EXE objects. However, GDI.EXE objects such as pens and brushes are not always freed, even when you close heavily graphics-oriented applications, and a portion of the GDI.EXE heap may be lost until you restart Windows.

That, unfortunately, is the only surefire cure for most low-resource situations—restarting Windows. If you regularly use multiple applications, you might need to exit and restart Windows three or four times a day. Of course, you should always reboot after a GPF, saving your data first, if possible.

Plug the Leak

How do you know if you have a resource problem, and what can you do in response? Here are some essential troubleshooting tips supplied by experienced Windows developers:

Use a third-party resource gauge. Hewlett-Packard's Dashboard 2.0 offers a resource monitor that resembles a fuel gauge and sits on the desktop. It's much handier than constantly hitting the Help menu in Program Manager. Stacker 3.1 for Windows provides a similar gauge. PC Tools for Windows includes a detailed list of applications showing how many system resources each has claimed. Look for the Local Heaps topic under the Windows menu in PC Tools' System Consultant. But the simplest solution of all is a public domain applet such as Resource Gauge, available in PC/Contact's data library 3 (Utilities/Misc.) as RESGAU.ZIP.

Spot resource leakers. There's nothing Holmesian about the sleuthing process—it's pure trial and error. Check resources. Load an application. Work with a file or two. Close the application. Check resources again. You'll spot a poorly-coded application after a few rounds. What next? Ask the developer when it plans to fix the problem. If the answer isn't "Soon," consider switching applications.

Suspect your video driver. Try using the generic VGA driver to see if the problem goes away. Switch from 256-color mode to 16 and test it some more. If the problem vanishes, look for an updated video driver.

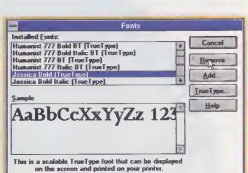
Prune your font list. When your list hits 400 or 500 fonts, you're on very thin ice. You'll see unpredictable side effects long before that.

Upgrade prudently. Minor fixes (from 4.0 to 4.01, say) are likely to clean up resource problems. Major upgrades are more likely to cause them. Don't be surprised if a complicated new app sucks away your system's resources like a vacuum cleaner at a sawdust convention.

Trim the fat. Dashboard uses fewer resources than Program Manager. Bitmaps and high-color drivers also consume resources Big Gulp-style. Dare to be dull! Lose the fancy wallpaper and animated icons. It's the nineties—understated elegance is in.

Switch to OS/2 2.1 or Windows NT. You may experience compatibility and configuration headaches with some applications, but these powerful 32-bit operating systems blow away the 64K resource barrier with a vengeance.

Wait for Windows 4.0. Microsoft will surely fix this grievous design flaw in the next version of Windows. Or did you want to get some work done this year?



Having lots of Windows fonts can take up lots of memory. Go into the Control Panel, double-click on the Fonts icon, and remove some of those you don't use.

To overcome the problem of the incredible shrinking system resource, refer to the System Consultant within PC Tools for Windows—it provides system configuration information.

Got a tip? Send it to Help, *PC/Computing*, 950 Tower Lane, 19th Floor, Foster City, CA 94404. We'll give you $50 for every tip we publish.

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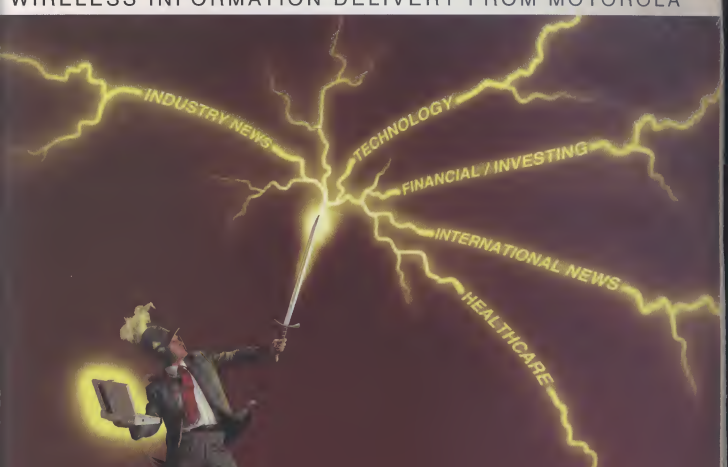

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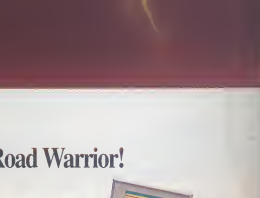

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Windows Hot Tips

INSIDE THIS MONTH

Cut and paste between DOS and Windows applications • Share your computer with others • Speed Windows launching

PROBLEM: You use DOS applications under Windows and want to use the Clipboard for cutting, copying, or pasting into or from Windows applications.

SOLUTION: Easy as pie—run the DOS application in a window (not full screen). You can do that with Windows' MS-DOS prompt, for example, by hitting Alt-Enter during your DOS session. You can also use the Windows program information file (PIF) Editor to change the DOS application's information, designating the display as Windowed. While that program is running as a Window, click on the control bar and select Edit, Mark. Using the mouse, block the text you wish to copy to the clipboard, then select Edit, Copy. Alternately, you may select Edit, Paste to paste text from a Windows application.

RENEE L. AHRBECKER
INDIANAPOLIS, INDIANA

PROBLEM: It never fails: As soon as you've finished arranging Windows to your liking, a colleague rearranges everything—windows, icons, and wallpapers.

SOLUTION: You need to keep two configurations—one for you and one for your colleague. Arrange Program Manager and File Manager according to your preference. Save this setup by making sure the Save Settings on Exit option is selected under the Options menu before exiting Windows. Change to your Windows directory (usually \WINDOWS), and type

```
COPY WIN.INI WIN.IN1
COPY SYSTEM.INI SYSTEM.IN1
COPY PROGMAN.INI PROGMAN.IN1
COPY *.GRP *.GR1
```

Return to Windows, let your colleague rearrange everything, save, and exit. Now type:

```
COPY WIN.INI WIN.IN2
COPY SYSTEM.INI SYSTEM.IN2
COPY PROGMAN.INI PROGMAN.IN2
COPY *.GRP *.GR2
```

Repeat the process for every additional user. Now create a batch file called WIN1.BAT as follows:

```
@ECHO OFF
COPY *.IN1 *.INI
COPY *.GR1 *.GRP
WIN
```

Repeat the process for WIN2.BAT, WIN3.BAT, and so on. User 1 should load Windows by typing WIN1 rather than just WIN, user 2 should type WIN2, and so on for every user. *Note:* If you install a new application and need to update the setting for any or all users, you'll have to repeat the entire process.

JIM BRUFF
LIVONIA, MICHIGAN

PROBLEM: Admit it—you're a fontaholic. You have 387 TrueType fonts, and you don't plan to give them up. The catch is, Windows loads very slowly when it carries the heavy baggage of too many fonts.

SOLUTION: You may need all those fonts when you use a desktop publishing program, but for other applications, you want a speedier startup procedure. Make a copy of your WIN.INI file and name it WIN.FNT. Using a text editor such as EDIT or SYSEDIT in Windows, search for FOT. Insert a semicolon (;) in front of each line that loads a TrueType font, such as

```
;ONYX BT (TRUETYPE)=TT0519M_.FOT
```

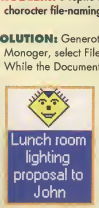
thus disabling that entire line. Leave Arial, Times New Roman, Courier, or any other of your favorite fonts intact (you need *some* fonts to work). Resave WIN.INI, and the next time you load Windows, it will come up significantly faster. You may also notice a certain increase in the available Windows Memory (at Program Manager, select Help, About Program Manager to view your available memory). Even if you don't notice it, your PC definitely will. For those occasions when you do need all those fonts, rename WIN.INI as WIN.OLD (or another similar name), and copy WIN.FNT to WIN.INI.

YAEL LI-RON
ASSOCIATE EDITOR

KILLER TIP: PROGRAM MANAGER

PROBLEM: Despite its improved interface, Windows still adheres to DOS's eight-character file-naming convention: It looks nice, but results in forgettable filenames.

SOLUTION: Generate icons for the files you access frequently. In Program Manager, select File, New, and select Group. Name the new group Documents. While the Documents group window is open, select File, New, Program Item.



After Description, type up to 40 characters, such as "Lunch room lighting proposal to John." After the command line prompt, type the filename—for example, LNCHLIT.DOC, a Word for Windows document—and after Working Directory, enter the directory where that file is stored. Assign an icon by clicking the Change Icon button and running through the treasure trove of icons, and you're done. When you double-click on this icon, it should launch Word for Windows and bring up the document. If you get an error message saying "No application is associated with the file," go into File Manager, select the file, and execute File, Associate, then select an application to run with this file.

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EDMONTON, ALBERTA, CANADA

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Seven Common Error Messages And What To Do About Them

Easy-to-follow tips to help you overcome your fear of cryptic messages.

Like any good operating system, DOS lets you know when something goes wrong by displaying an error message. Some error messages are self-explanatory, but others are downright cryptic. What do you do, for example, when DOS locks up your PC after telling you, "Exception error #12–press Enter to reboot"?

If you're a new user, even the simplest and most common error messages may be confusing. You may know what "Bad command or filename" means, but what about the worker across the hall who just got a PC? Here is an explanation of the seven most common DOS error messages you're likely to encounter and what to do when you get them.

1. Bad command or filename. When you type a command at a prompt or attempt to execute one from a batch file, DOS tries three ways to look for it. First, it searches its own list of resident commands—commands such as CLS, DIR, and TYPE—to see if what you typed matches a name in that list. If that fails, it searches the current directory for a file of the same name with the extension .COM, .EXE, or .BAT. If that also fails, it searches for the .COM, .EXE, or .BAT file in every directory named in your PATH statement. If none of these searches turns up a match, DOS throws up its virtual hands and says, "Bad command or filename."

Usually, this error message means that you mistyped the command (for example, you typed DUR instead of DIR), that you're in the wrong directory, or that your PATH statement does not include the directory in which the command file is located.

To correct this final problem, modify your AUTOEXEC.BAT file's PATH line and reboot. Then you'll be able to execute the command from any directory. If the error message appeared while a batch file was running and you're using MS-DOS 6.2, you can identify the command that prompted the error using MS-DOS 6.2's new interactive batch feature. Just type COMMAND /Y /C followed by the batch filename to run the batch file interactively.

2. Out of environment space. This is another error message that you're likely to get while a batch file is running. Many batch files use SET commands to create environment variables. At startup, COMMAND.COM sets aside a fixed amount of space to hold environment variables. (Actually, COMMAND.COM can enlarge the space dynamically if the conditions are right, but conditions aren't always favorable.)

By default, COMMAND.COM provides only 256 bytes for environment variables in MS-DOS 5 and MS-DOS 6, and a mere 160 bytes in some of the earlier versions. The solution is to add a /E switch to COMMAND.COM specifying a more generous environment space. Check your CONFIG.SYS file. If it currently contains the following statement:

```
SHELL=C:\DOS\COMMAND.COM C:\DOS /P
```

then modify it to read

```
SHELL=C:\DOS\COMMAND.COM C:\DOS
  /E:1024 /P
```

to increase the environment size to 1,024 bytes (1K). If CONFIG.SYS currently lacks such a SHELL statement, add one. Then reboot so that your change can take effect. *Note:* In MS-DOS 3.1, specify the desired environment size in bytes divided by 16 with the /E switch—/E is not supported in Version 3.0 and earlier.

Another possible fix is to clean up the PATH statement. If you've given yourself a PATH to every directory and subdirectory on your hard disk, you may want to reevaluate that plan of action, because a long PATH takes up environment space. You don't need a PATH to all your applications if you launch them from within Windows or from a menu.

3. Cannot load COMMAND, system halted. The above SHELL statement tells COMMAND.COM that it is being loaded from the \DOS directory of drive C:. This information is essential because in order to conserve memory,

```
C:\>COMMAND /Y/C CDB.BAT
CDB.BAT [Y/N]?Y
ECHO OFF [Y/N]?Y
IF EXIST GOTO ERROR [Y/N]?N
IF NOT EXIST GOTO ERROR [Y/N]?N
FOR %R IN <> DO SET DIR=%R [Y/N]?Y
FOR %%I IN <> DO IF %%~A%%I EQ FLAG=TRUE [Y/N]?Y
FOR %%I IN <> DO IF %%~A%%I EQ FLAG=TRUE [Y/N]?Y
FOR %%I IN <> DO IF %%~A%%I EQ FLAG=TRUE [Y/N]?Y
FOR %%I IN <> DO IF %%~A%%I EQ FLAG=TRUE [Y/N]?Y
CD %. [Y/N]?Y
SET DIR= [Y/N]?Y
SET FLAG= [Y/N]?Y
GOTO END [Y/N]?_
```

Batch file crashing? Debugging batch files has never been easier. In MS-DOS 6.2, type COMMAND /Y /C, then the name of your batch file, and you'll run through the file line-by-line until you find the bug.

DOS APP OF THE MONTH

VDEL 2.0

Here is the command that Microsoft forgot. VDEL 2.0 prompts you for confirmation of each deletion, with an extra prompt for read-only files. You can also delete files across subdirectories. Download VDEL20.ZIP from PC/Contact's data library 3 (Utilities/Misc.). VDEL is part of Tessler's Nifty Tools and is available for $19, or $49 for the complete 25 program collection. Order directly: Tessler's Nifty Tools, P.O. Box 1791, San Ramon, CA 94583.

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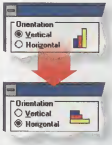
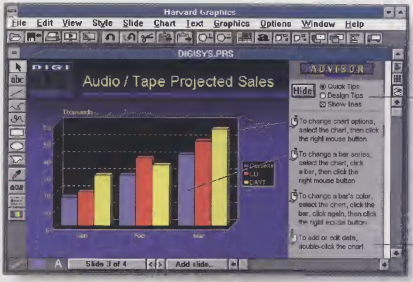
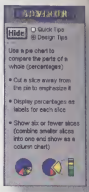


In what form will your charts be more motivational? Vertical or horizontal? Flat or three-dimensional? Find out before you print with a mouse-click in QuickLooks.





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COMMAND.COM loads about half of itself into a section of memory that's normally unused, allowing application programs to overwrite it if they need the space. When this happens, COMMAND.COM reloads its other half from disk. If COMMAND.COM can't find itself on disk, it displays the message "Cannot load COMMAND, system halted," and it locks up.

There are two ways to correct this problem. One is to make sure that the path specifier following

```
C:\DOS\COMMAND.COM
```

in the SHELL statement specifies the true path to the file. Alternately, you may add a SET COMSPEC command to your AUTOEXEC.BAT file specifying the path—for example,

```
SET COMSPEC=C:\DOS\COMMAND.COM
```

This error message may also appear if the copy of COMMAND.COM that COMSPEC points to is corrupted or is from another version of DOS. The solution is to replace the corrupted or invalid file with a fresh one by copying COMMAND.COM from the root directory to the \DOS directory.

4. Unrecognized command in CONFIG.SYS. If your CONFIG.SYS file contains a command that DOS does not recognize, you'll see this error message as your PC boots up. Mistyping DEVICE= as DVICE=, for example, will produce this message. Correct the error in CONFIG.SYS and the error message will go away. The "Error in CONFIG.SYS line *nn*" message following "Unrecognized command in CONFIG.SYS" identifies the line containing the unrecognized command.

5. Bad or missing filenome. Here's another common CONFIG.SYS error message, one that usually occurs when a DEVICE or DEVICEHIGH command specifies a nonexistent device driver. You'll get this message, for example, if you type

```
DEVICE=C:\DOS\HIGHMEM.SYS
```

instead of

```
DEVICE=C:\DOS\HIMEM.SYS
```

6. Stock overflow, system holted. *Note:* If you're using MS-DOS 5's or MS-DOS 6's EMM386 driver, this message may show up as "Exception error #12."

In order to prevent system crashes resulting from too many hardware interrupts occurring in too short a time, DOS provides stack space to hardware interrupts from its own pool of internal system stacks. The size of each stack and the number of internal stacks that DOS sets up is determined by the STACKS setting in CONFIG.SYS. The STACKS syntax is: STACKS=*N*,*S*—where *N* specifies the number of stacks allocated, and *S* is the size of each stack in bytes. Valid values for *N* are between 0 and 64 in increments of 8; valid values for *S* are 32 through 512. Too low a setting—for example, STACKS=0,0—can produce this error message long after your PC has booted up.

To eliminate the error, increase the value of the STACKS setting. The proper setting must be determined through trial and error. For starters, try using STACKS=8,128. If that doesn't work, try STACKS=8,256, then STACKS=16,128, then STACKS=16,256, and so on.

7. Incorrect DOS version. Almost every external command file supplied with DOS checks the DOS version when it runs, and displays this error message if the version of DOS that you're running is not the one that the command file was distributed with. This frequently happens if you've upgraded DOS versions but you've left some of the older version's files on your hard disk.

One solution is to identify the old command file and replace it with the one from the DOS version that you're now using. If the command was dropped in a subsequent release of DOS and you're currently using MS-DOS 5 or MS-DOS 6, you can make the old one work using DOS's SETVER command and SETVER.EXE driver. To load SETVER into high memory, add the following line to your CONFIG.SYS file, following the HIMEM.SYS and EMM386.EXE lines:

```
DEVICEHIGH=C:\DOS\SETVER.EXE
```

This is usually safe, but in some cases (you'll have to experiment) things will go awry. Tread carefully.

SUREFIRE DIAGNOSTICS

There comes a time when knowing what an error message means doesn't help. Despite your best efforts, the problem stays. Or worse, it transmogrifies into another problem. For persistent, inexplicable error messages you probably need to consult with diagnostic software.

MSD is free. First try MSD, the Microsoft System Diagnostic utility. It comes free with Windows 3.1 and DOS 6. You can troubleshoot problems such as memory and IRQ address conflicts and even find out about your hardware—for example, how many COM ports you have. The full MSD report usually takes up several pages, but it's really useful to have a hard copy of it—particularly if your system's CMOS becomes corrupted and you want to know just what kind of hard drive is in there. For the most accurate results, don't run MSD from Windows.

CheckIt Pro is more robust. For more muscle, try CheckIt Pro: SysInfo 1.0 from Touchstone Software. This powerful DOS-based diagnostic program can diagnose elusive problems such as faulty I/O cards and bad memory chips, and even tell you the DIP switch settings on various system components.

The comprehensive SysInfo utility goes under your system's hood to ferret out details about your I/O bus, your video board's chip set, the hard disk's interface type, and all sorts of other information you'd need a screwdriver to get.

For those nagging problems, run the Burn-In test in a continuous loop—it's the same test many retailers use to test new systems.

CheckIt Pro: SysInfo 1.0 offers two interfaces: an intuitive quasi-graphical menu system and a command-line interface. The suggested retail price is a lot more than MSD at $149.95, but it's probably worth it. There's even a Windows version, CheckIt Pro: Analyst for Windows 1.0, also for $149.95. To test your parallel and serial ports you'll need loopback plugs (sold separately for $9.95, including 2 serial plugs—9- and 25-pin, and one parallel). Call TouchStone Software at (714) 969-7746. **YAEL LI-RON**

Circle No. 779 on Reader Service Card

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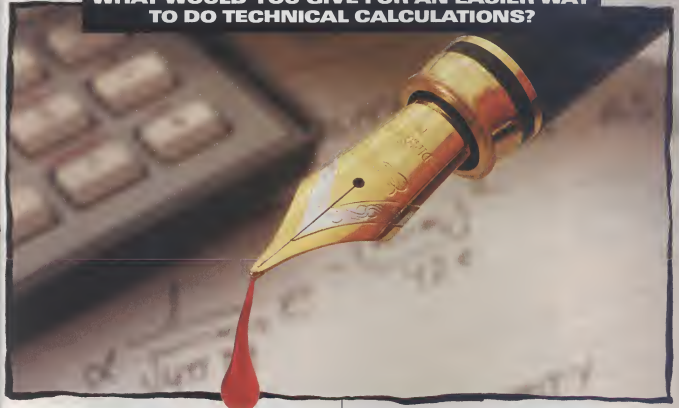

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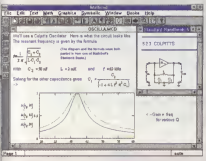

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Circle 242 on reader service card.

INSIDE THIS MONTH

Hide your files from snoops • Eject paper from a laser printer • Add directories to your path on the fly

PROBLEM: Snaapy co-workers ore always laaking far your files.

SOLUTION: The DIRCMD (directory command) function tailars the way o directary is displayed. SET DIRCMD=AH, far example, sets the default DIR optian to display all hidden files. Ta hide yaur files fram unauthorized snaaps, add the fallawing line ta yaur AUTOEXEC.BAT file:

```
SET DIRCMD= 0
```

Since this is nat ane of the available aptians, typing DIR will yield a "File nat faund" message, suggesting the terrifying passibility that your entire drive is empty. You may still view all yaur files by typing DIR *filename*, as in DIR C:\DOS or DIR *.WK1. To reset DIR ta narmal, type SET DIRCMD= at any prampt.

DEAN R. LAMBE
PLATTSBURGH, NEW YORK

PROBLEM: Loser printers dan't process a farm feed (eject paper) unless they're tald to. If yau press the Print Screen key, you may need ta manually eject the paper, using the Farm Feed button. The same problem occurs if yau issue the cammand TYPE *FILENAME*>PRN.

SOLUTION: Using EDIT or another text editar, create the following batch file and name it EJECT.BAT:

```
@ echo off
echo♀ > prn
echo All done!!! Paper
   ejected!!!
```

Ta insert the ♀ symbol in EDIT, press Ctrl-P, then hold dawn the Alt kaye and first press the numeric keypad's 1 key, then its 2 key (while still holding down the 1 key).

YAEL LI-RON
ASSOCIATE EDITOR

PROBLEM: You need to tempororily add a directory to your path.

SOLUTION: ADDPATH.COM adds directaries ta the path on the fly. Create ADDPATH.SCR using a text editar:

```
N ADDPATH.COM
E 0100 B4 30 CD 21 3C 02 72 16
E 0108 FC BE 80 00 32 ED 8A 0C
E 0110 E3 0C 8B FE 41 B4 20 46
E 0118 38 24 77 05 E2 F9 E9 D1
E 0120 00 AC 3A C4 76 10 3C 3B
E 0128 74 0E 3C 61 72 0F 3C 7A
E 0130 77 08 2A C4 EB 07 B0 3B
E 0138 38 45 FF 74 01 AA E2 E1
E 0140 81 EF 80 00 76 4A 89 3E
E 0148 FA 01 26 8E 06 16 00 26
E 0150 3B 06 2C 00 74 09 26 A1
E 0158 2C 00 E2 EE E9 93 00 8B
E 0160 D0 48 8E C0 26 8B 0E 03
E 0168 00 E3 25 D1 E1 D1 E1 D1
E 0170 E1 D1 E1 8E C2 33 DB 26
E 0178 80 3F 50 75 10 26 81 7F
E 0180 01 41 54 75 08 26 81 7F
E 0188 03 48 3D 74 05 43 E2 E7
E 0190 EB 60 83 C3 05 83 E9 05
E 0198 76 58 89 1E FC 01 26 80
E 01A0 3F 00 74 05 43 E2 F7 EB
E 01A8 49 8B C3 2B 06 FC 01 A3
E 01B0 FE 01 4B 8B F3 41 26 83
E 01B8 3F 00 74 05 43 E2 F7 EB
E 01C0 31 43 43 2B DE 2B 0E FA
E 01C8 01 76 27 03 F3 8B FE 03
E 01D0 3E FA 01 8B 0E FE 01 03
E 01D8 CB 8E DA FD F3 A4 FC 0E
E 01E0 1F BE 80 00 8B 0E FA 01
E 01E8 8B 3E FC 01 F3 A4 FE 0E
E 01F0 F9 01 A0 F9 01 B4 4C CD
E 01F8 21 01
RCX
00FA
W
Q
```

Ta create ADDPATH.COM, type

```
DEBUG<ADDPATH.SCR
```

Ta add a directary ta yaur path, type

```
ADDPATH <directory name>
```

Far example:

```
ADDPATH C:\TEMP
```

ED QUILLEN
SALIDA, COLORADO

KILLER TIP: RESTART.COM

PROBLEM: You need to reboot yaur system fram within a batch file. For example, yau're creating a hamegrawn installation procedure that madifies CONFIG.SYS or AUTOEXEC.BAT, and you want the changes ta take effect.

SOLUTION: RESTART.COM, a small but handy utility. In a text editar such as EDIT, type the following lines:

```
N RESTART.COM
E 100 B8 40 00 8E D8
E 105 B8 34 12 BB 72
E 10A 00 89 07 EA 00
E 10F 00 FF FF
RCX
18
W
Q
```

Save the file as RESTART.SCR. Ta create RESTART.COM, type DEBUG<RESTART.SCR. You may naw add the RESTART line ta yaur batch file. Warning: Da nat launch RESTART.COM fram within Windaws! If yau da you'll da a nasty rebaat, leaving partial files all around.

SEAN MOLLET
BILLINGS, MONTANA

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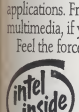

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Circle 215 on reader service card.

App Tips: Word Processors

INSIDE THIS MONTH

Create WordPerfect macro line numbers • Better graph titles in Excel • Speed up Paradox • Make PC Tools' Tag Along work

WordPerfect 6.0 for DOS

PROBLEM: DOS's EDIT is too sportian for viewing ond editing text files.

SOLUTION: Use the undocumented text editor ED.EXE that comes with WordPerfect 6.0. In DOS, switch to the WPC60DOS directory and type ED.EXE at the prompt. The editor loads quickly and feels a lot like WordPerfect 5.1, right down to the use of F3 for help and F7 to exit. ED.EXE also includes a List Files File Manager with the look and feel of WordPerfect 5.1.

RENÉ DELAUP
NEW ORLEANS, LOUISIANA

Word 6.0 for Windows

PROBLEM: Although useful, the Word for Windows Draft is not o separate view but a font attribute of the Normol view.

SOLUTION: Use the following macro to treat the Draft font as another view and quickly switch between the Page/Normal/Draft/Outline views. The code also toggles macros between Normal/Draft views—a useful feature when you need a proportional font view to see how your dialog box lines will break.

```
Sub MAIN
REM WOPR 6.0 ChangeViews
REM Switches from Page to Normal
   to Draft to Outline to Page View
If SelInfo(27) Then
 Print "Toggling Draft On/Off"
 ViewDraft
ElseIf ViewPage() Then
 Print "Changing Page -> Normal
   View"
 ViewNormal
 ViewDraft 0
ElseIf ViewNormal() Then
 If ViewDraft() Then
  Print "Changing Draft -> Outline
   View"
  ViewOutline
 Else
  Print "Changing Normal -> Draft
   View"
  ViewDraft
 EndIf
Else
 Print "Changing Outline -> Page
   View"
 ViewPage
End If
End Sub
```

Assign the macro to a button on your toolbar and you can toggle back and forth between the views, even when editing macros.

WOODY LEONHARD
COAL CREEK CANYON, COLORADO

Ami Pro 3.0

PROBLEM: You need to exit Windows fast, but you hove a document loaded in Ami Pro ond three other applicotions running.

SOLUTION: Use the following macro to save all of your open documents, shut down Ami Pro, close your other applications, and exit Windows. To create it, select File, New, highlight the Macro style sheet, and click on OK. Next, enter the following code on the sheet:

```
FUNCTION ExitWindows()
Count=GetOpenFileCount()
If Count > 0
For X=1 to Count
File=GetOpenFileName$()
If File="" And FileChanged(0,0) >
  0
  SaveAs("untitled.sam",32,"","")
ElseIf FileChanged(0,0) > 0
  Save()
  Else
 EndIf
 Next
EndIf
Answer=MultiDecide("This will end
   your Windows session.",17,"Exit
   Windows")
If Answer=2 Then Exit Function
EndIf
hExitWindows=DLLLocate
   ("User","ExitWindows","H")
ExWin=DLLCall(hExitWindows)
END FUNCTION
```

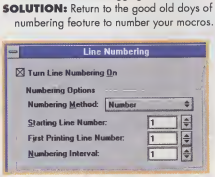
Select File, Save As and type in EXIWIN.SMM as the filename. Choose Ami Pro Macro as the file type and click on OK. Select Tools, Macro, and Playback Macro. In the Playback Macro dialog box, move the cursor to the Playback Shortcut Keys box and select Shift-Ctrl-Q to assign as the shortcut key. Click on OK to close the dialog box and save your changes.

CHRIS RICHARDS
PENFIELD, NEW YORK

KILLER TIP: WORDPERFECT 6.0

PROBLEM: WordPerfect's macro compiler returns error messoges with obscure line references when debugging mocros.

SOLUTION: Return to the good old doys of BASIC by using WordPerfect's line numbering feature to number your mocros. Ploce the cursor ot the beginning of your code, select Loyout, Line, Numbering, ond click on the Turn Line Numbering On box in the Line Numbering diolog box. Line-numbered mocros compile and run without o problem.



The next time the compiler tells you there is on error in line x, you'll olreody hove the reference point morked in your mocro.

WILLIAM J. WOLFE
CHAMPAIGN, ILLINOIS

The first truly programmable trackball is first in something even more important.

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Expert Mouse 4.0

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Circle 245 on reader service card.

App Tips: Spreadsheets

Lotus 1-2-3 Release 4

PROBLEM: Release 4.0's SmartIcon Editor lets you drow gorgeous custom icons to execute your own macros, but your artistic skills are limited to stick figures.

SOLUTION: There's an easy way to put a simple image on a custom SmartIcon: Paste it from the Clipboard. To insert a large Z on a custom SmartIcon, enter Z into any spreadsheet cell (leave it left-aligned), and format it with the color and shading that you prefer. Use the Edit Copy command to copy it to the Clipboard. Select Tools, SmartIcons and then click on the Edit Icon button. Click on the Paste Icon button to copy the Clipboard's contents to the icon. The letter, as well as the formatting, will appear in the icon.You may then tweak it if you'd like a different effect. You may have to experiment with font sizes in order to get a properly sized character into the icon. This technique is particularly handy for symbol fonts such as WingDings when you want to use graphic characters like a telephone, happy face, or file cabinet.

ROBIN J. WALDEN
LA JOLLA, CALIFORNIA

Quattro Pro 5.0 for DOS

PROBLEM: Blank rows separating records in a database make them easy to view, but their existence makes it difficult to edit the spreadsheet (copying, deleting, or formatting discontinuous blocks, for example).

SOLUTION: Use the following macros to add and delete blank rows. In the example, cell A30 is the start of the database.

To insert rows starting at cell A50, use the following macro:

```
A
50{goto}a30~
51{down}~
52/eir~
53{down}~
54{if @cellpointer("con-
  tents")="***END"}{quit}~
55{branch a52}~
```

To name the macro, select /Edit, Names, Create, type \i for the name and select the macro range for its location. And, to delete rows starting at cell A60, use this macro:

```
A
60{goto}a30~
61{down}~
62/edr~
63{down}~
64{if @cellpointer("con-
  tents")=""}{branch a62}~
65{quit}~
```

Be careful with this second macro: If you run it when you don't have blank rows, it will delete rows with contents. To name the macro, select /Edit, Names, Create, type \d for the name and A60 for its location. You'll need to insert the word "***END" immediately after the last record to flag the end of the database, as follows:

```
Sample database (starts at A30)
 A
30San Francisco
31Los Angeles
32New York
33***END
```

To run these macros, type Alt-I or Alt-D, respectively.

SHIV MURTI
TORRANCE, CALIFORNIA

Lotus 1-2-3 2.x and 3.x

PROBLEM: Lotus 1-2-3 uses the @ character to insert the date in a header or footer, but there's no TIME function.

SOLUTION: Put the following formula in a cell that's outside of your print range. (*Note:* This is one formula; you must type it all in one cell or it won't work.)

```
@STRING(@HOUR(@NOW),0)&":"&@IF(@VA
  LUE(@STRING(@MINUTE(@NOW),0))<10
  ,"0"&@STRING(@MINUTE(@NOW),0),@S
  TRING(@MINUTE(@NOW),0))
```

When you define a header or footer, reference this time cell by typing \CELL, for example: \A55.

DOUGLAS BLEYAERT
MONROE, MICHIGAN

PROBLEM: Lotus 1-2-3 for DOS doesn't have an Autofill feature like its Windows counterpart. What can you do if you need to enter Jan-94 through Dec-95 as column headings in your worksheet, but don't feel like typing them yourself?

SOLUTION: Lotus 1-2-3 for DOS includes a function to use dates for cell fills—it's just well-hidden. This technique is called Date Numbers, and it works with dates back to January 1, 1900—well before most of us were born. Select Data Fill, and specify the cell range where you want your months to go (for example, B2..Z2). For Start value, type @date(94,01,15). For Step, type 30, and for Stop type @date(95,12,31). Now format the range: Range, Format, Date, 3 (MMM-YY), and specify the same range.

YAEL LI-RON
ASSOCIATE EDITOR

KILLER TIP: MICROSOFT EXCEL

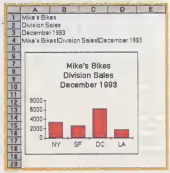
PROBLEM: You want to insert text from two or more cells of your worksheet into the title of a Microsoft Excel chart.

SOLUTION: Let's say the text you want to use is in cells A1, B1, and C1. Type the following formula in cell D1:

=A1&CHAR(13)&B1&CHAR(13)&C1

To insert the text into the chart title, click on the Chart menu, select Attach Text, click on OK, click on the Formula Bar, backspace over anything there, and type:

=Sheet1!D1



REED JACOBSEN
ARLINGTON, WASHINGTON

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dBASE IV

PROBLEM: You need to calculate employees' ages in a report using information from a field called birthday in a database called employee.

SOLUTION: Here's a user-defined function (UDF) that does just that:

```
FUNCTION Age
PARAMETERS birthday
PRIVATE thismonth, bmonth, age
IF TYPE("birthday")<>"D" .OR.
   YEAR(DATE()) <YEAR(birthday)
 RETURN (0)
ENDIF
thismonth=MONTH(DATE())
bmonth=MONTH(birthday)
age=YEAR(DATE())-YEAR(birthday)
IF (thismonth<bmonth) .OR. (this-
   month=bmonth .AND.
   DAY(DATE())<DAY(birthday))
 age=age-1
ENDIF
RETURN Age
```

To create a new procedure file, type MODIFY COMMAND MYPROC and add these lines. If you already have a procedure file, just add these lines to it.

VINCENT O'CONNOR
BABBITT, MINNESOTA

PROBLEM: Creating picklists in a dBASE program is usually a lengthy and convoluted coding process that most programmers would rather avoid.

SOLUTION: Using the multiple choice function, let users create, edit, and update this mock picklist on the fly. Note that this picklist is limited to 72 characters.

```
PROCEDURE PICKLIST
SET SAFETY OFF
SET COLOR TO W+/B,GR+/BR
CLEAR
IF FILE("SALESTAFF.MEM")
 RESTORE FROM SALESTAFF.MEM ADDI-
   TIVE
ELSE
 SALESTAFF="NONE"
ENDIF
SALESTAFF=SALESTAFF+SPACE(72-
   LEN(SALESTAFF))
@10,14 SAY "Enter a rep's name or
   press [Esc] to exit..."
@12,03 GET SALESTAFF VALID .NOT.
   ""= ;
TRIM(SALESTAFF) ERROR "Enter a
   name!"
@14,18 SAY "Important! Separate
   names with commas!"
READ
CLEAR
SALESTAFF=TRIM(SALESTAFF)
SAVE ALL LIKE SALESTAFF* TO
   SALESTAFF.MEM
**EOP PICKLIST
PROCEDURE EDITLIST
SET COLOR TO W+/B,GR+/B
CLEAR
IF FILE("SALESTAFF.MEM")
RESTORE FROM SALESTAFF.MEM ADDI-
   TIVE
@10,16 SAY "Choose a rep or press
   ;
[Esc] to exit..."
GET SALESTAFF FUNCTION "M
   &SALESTAFF" ;
MESSAGE "Press [Space] to view
   more names"
READ
ENDIF
RETURN
**EOP EDITLIST
```

The best way to implement this tip is to add the above code to the file LIBRARY.PRG, which will make this program available globally.

MICHAEL FERLISE
WALNUT CREEK, CALIFORNIA

FoxPro 2.5 for DOS

PROBLEM: FoxPro doesn't offer a function for typing a centered string in a @SAY statement.

SOLUTION: Create a "Center" UDF and add it to your procedure file.

```
function center
 parameters Column
 column=(80-len(thestring))/2
return column
```

To use CENTER(), simply type @ROW,CENTER() SAY THESTRING. For example,

```
THESTRING="Main Menu"
@5,CENTER() SAY THESTRING
```

And that's all it takes.

MICHAEL FERLISE
WALNUT CREEK, CALIFORNIA

Microsoft Access 1.1

PROBLEM: You want to combine information from two tables, including their unique counter fields, but Access limits you to one counter field per table.

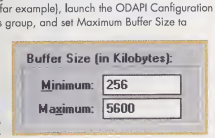
SOLUTION: Create a form with an embedded subform. Assuming you have a database with Customer and Product tables, create a Main/Subform and add the customer, address, and home fields from the first table to the Main form. While in Design View, click on the Subform and select View, Properties. Enter the name of the second table in Object Source. Next, enter the names of fields from the second table (product, category, price) in the Link Child Fields and Link Master Fields properties. Your single form now displays both sets of data. An alternative is to base your form on a query, but the subform method is probably easier.

KAREN JENSEN
SAN FRANCISCO, CALIFORNIA

KILLER TIP: PARADOX 4.5

PROBLEM: Routine database operations in Paradox for Windows seem to perform on a glacial time scale and you want your results today.

SOLUTION: If your application is long on back-end database work but doesn't use a lot of graphics (graphs and forms, for example), launch the ODAPI Configuration Utility from the Paradox for Windows group, and set Maximum Buffer Size to equal 80 percent of your total RAM. ODAPI table performance will improve significantly for running queries, updates, and the like, but other Windows tasks may suffer, especially graphical displays.



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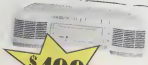

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App Tips: Alternative Windows Desktops

PC Tools for Windows

PROBLEM: The Tog Along feature in PC Tools for Windows does not work with all applications.

SOLUTION: To keep your most frequently used applications on your current desktop, create a script that uses the Tag Along feature with any application. Open the Scripttools Macro folder and double-click on the Scripttools icon. To start an application minimized and "tagged-along," with icons across all of your desktops, type in the following script:

```
Exec "APP.EXE"
x$=ActiveWindow$()
if Minimized(x$)=0 then
 attach x$
 Minimize
 endif
Wk_Tagalong = 291
SysMenuSelect Wk_Tagalong
```

Replace APP.EXE with the name of the file that launches your application, and save the script as APPTAG.SCT. *Note:* The application must be defined in WIN.INI or must reside on the PATH. Click on Test Run and PC Tools will compile the script into an executable code with the name APPTAG.RUN.

To launch the script from an icon, create a new File Item with C:\CPS\WNSRUN.EXE C:\CPS\DATA\APPTAG.RUN as the command line in the Properties dialog box. Change the drive and directory to reflect where you've installed PC Tools and where you've filed the runtime script. *Note:* Some applications do remember the Tag Along setting from session to session. If your application already holds a Tag Along setting like this, don't use this code. Select Tag Along from the Command Menu by clicking on the Command Icon.

JEFFREY CARR
ARLINGTON, VIRGINIA

Norton Desktop 2.2

PROBLEM: Even with the Current Drive Window option of the Drive Windows feature, Norton Desktop 2.2 for Windows con't discretely tile windows side by side.

SOLUTION: Take full advantage of your display with two Norton Desktop batch files to tile two drive windows anywhere onscreen. First, create this file in Batch Builder to tile two C: drive windows:

```
SendKey('^w{ENTER}')
WinPlaceSet(@NORMAL,"C:\","0 535
  911 1008")
SendKey('^w{ENTER}')
WinPlaceSet(@NORMAL,"C:\","0 65
  911 535")
Exit
```

Save the file as 2DRIVE.WBT in your Norton Desktop subdirectory, and add it as a menu item under Disk as Open Dual Windows. Run it from your chosen menu to display the two C: drive windows. Next, use Batch Builder to create the following script:

```
ClipPut(WinPlaceGet(@NORMAL,
  "C:\"))
```

Save it as GETCORDS.WBT and assign it to Norton Desktop's Launch List with Get Win Coordinates for Text and C:\NDW\GETCORDS.WBT for Command Line. Finally, run Open Dual Windows and size the two windows the way you want them to appear. Click on the bottom window and start Get Win Coordinates from the Launch List.

The script places a series of four numbers separated by spaces in the Clipboard. Use these numbers to replace those in quotations on the second line of 2DRIVES.WBT. Click on the other drive window and repeat the process, plugging the numbers for that window in to the fourth line of the listing. Next time you run Open Dual Windows, they'll tile the way you've chosen.

To show drive D: in the bottom window instead of a second C: drive, insert {DOWN} directly before {ENTER} in the first line of 2DRIVES.WBT with no spaces, and replace "C:\" in the second line with "D:\". If you have both A: and B: drives, add {UP}{UP} and {UP} respectively to access them, and change the drive designations accordingly. If you have only an A: drive, use only a single {UP}.

SCOT FINNIE
SAN MATEO, CALIFORNIA

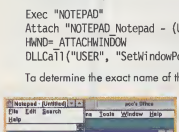
KILLER TIP: PC TOOLS

PROBLEM: A frequently used application lies buried under several windows without an Always on Top feature to keep it visible.

SOLUTION: Create a PC Tools script to make any Windows application mimic the Always on Top feature. You'll know that your Windows 3.1 application already has the feature if it has an Always on Top flag to check on or off in the Control Menu Box. If it doesn't, type the following script in Script Tools. In this example, we've loaded Notepad:

```
Exec "NOTEPAD"
Attach "NOTEPAD Notepad - (Untitled)1"
HWND= ATTACHWINDOW
DLLCall("USER", "SetWindowPos", HWND, -1, 0, 0, 0, 0, 64)
```

To determine the exact name of the Window in line two, select Create, Attach Name from the Script Tools menu. In the Attach Name dialog box, click on the Identify button and move the magnifying glass cursor over the Window you want identified. You will have to experiment with the 0,0,0,0 switches to get the actual position and size you want. Using the 0,0,0,0 will place a small Window at the top left.



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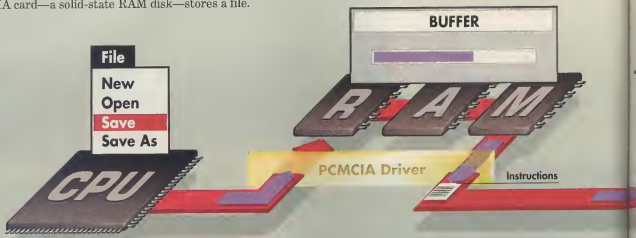
PCMCIA Peripheral Devices

How a credit-card–sized peripheral acts as a hard disk.

By Ron White. Illustrated by Timothy Edward Downs

Despite their diminutive stature, Personal Computer Memory Card International Association (PCMCIA) peripherals pack a whollop. With a little help from special software, called a driver, these devices look just like their full-sized cousins to your operating system. Here's how a typical PCMCIA card—a solid-state RAM disk—stores a file.



2 When you select the Save command from your application, the driver for the PCMCIA card intercepts the data destined for the card. Instead of sending it directly to the PCMCIA card, it routes the data to a temporary holding area, or buffer, in system memory on the PC.

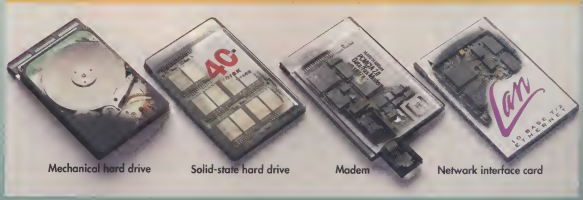
1 Slide your PCMCIA RAM disk into your notebook, then turn the notebook on. If it's configured correctly, a small program, called a PCMCIA driver, will load into the notebook's memory and start "listening" for applications that try to talk to the PCMCIA card.

3 The driver takes the data from the holding area, combines it with instructions telling the PCMCIA card what to do with it, and forwards this package to a PCMCIA controller chip located on the PC's motherboard. The controller chip sends the data to the PCMCIA card.

4 Dedicated circuits within the card read the instructions coming from the PCMCIA controller and use that information along with a map of memory addresses to route the file information to the PCMCIA card's own RAM. A built-in, low-power cell battery maintains the data stored on the card when the system is powered down.

VARIETY IS THE SPICE OF PCMCIA

A PCMCIA device can just as easily be a network interface card, modem, or hard drive: You'll have a different card and a different software driver, but the operation is exactly the same.



Do Disturb! PC Hardware IRQs And What They Mean to You

How to deal with peripherals grabbing at your CPU's proverbial skirt.

Installing your new network board seemed simple enough when you started. You plugged in the board, connected the cable, and installed the software without a problem. But after an hour of head-scratching and double-checking, you still can't get it to work. What's worse, you can't get any response from your CD-ROM drive or your modem—both of which were previously working. Unbeknownst to you, you're participating in your PC's favorite game show: Wheel of Interrupt.

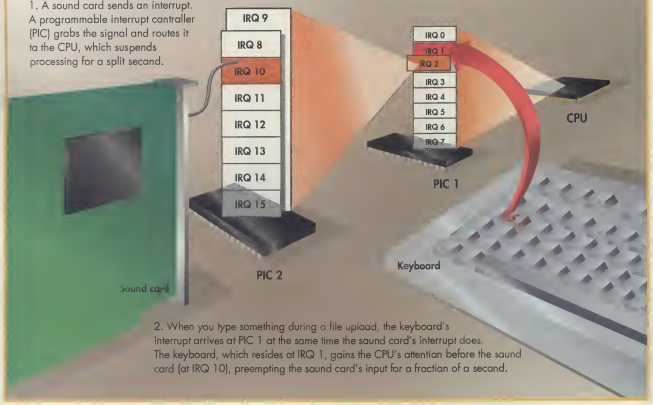
If you're assembling a high-end PC, you're probably planning to include a network card, modem, CD-ROM drive, SCSI hard drive, page scanner, tape drive, and sound board. Adding these capabilities to your PC should be as easy as plugging in the boards. But far too frequently, this simple task turns into a marathon troubleshooting session. When the smoke clears, the culprit is usually a contention between two or more boards over which one owns an interrupt request (IRQ) line.

Computers usually use one of two traditional methods of communications between the central processor and the peripherals. In the first method, the processor initiates all communications; the system peripherals simply sit and wait. Periodically, the processor will send a message to each peripheral asking, "Do you require any processing time?"

Under this method, called *polling*, the processor controls how often and for how long each peripheral will be serviced. Because the processor allocates its own time, it can ensure that no single peripheral hogs the system. Conversely,

CASCADING HARDWARE IRQs

Each IRQ in a PC corresponds to a peripheral device. By properly managing the use of IRQs, users can add as many devices as can fit in the 15 hardware IRQs.



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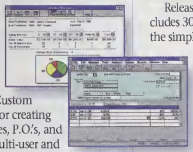

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because the processor initiates all communications, there is no way for a peripheral to demand immediate attention.

Your desktop PC is built around a member of the Intel 80x86 family of processors (or a compatible processor). Though there's a radical difference in processing power and capability across the spectrum from 8088 to Pentium, these processors share a family characteristic: They're all interrupt-driven.

In an interrupt-driven system, peripherals actually interrupt the processor to demand processing time; they are running the show. The processor waits for an interrupt, then services the demand for processing as quickly as possible. This service-on-demand philosophy still leaves the processor some flexibility, however, since it has the capability to ignore the interrupt or postpone action.

Peripherals generate interrupts in the course of normal operation. Pressing the A key on your keyboard, for example, generates an interrupt. The interrupt causes the processor to stop whatever it was doing and execute a section of code that interprets the pressed key and places the character A into the keyboard buffer.

Hardware interrupts occur quite frequently. The PC's timer generates an interrupt 65,536 times each hour (approximately 18.2 times per second). A serial data transfer from a V.42bis modem may generate as many as 57,600 interrupts each second. A fast typist can easily generate 10 to 15 interrupts per second. With all these interruptions, you may wonder whether the processor has time to do anything useful.

Organizing Interrupts

Hardware generates interrupts by sending a signal to the INTR (interrupt) pin of the processor. Tying every peripheral directly to the processor's INTR pin, however, would cause chaos—the computer equivalent of a roomful of people shouting at once. Worse, the processor couldn't identify which peripheral needed service.

To make sure the processor doesn't get confused, the interrupt signals that arrive at the INTR pin of the processor do not come directly from the peripherals. Instead, the IRQ lines of the PC run from the peripherals to a specialized chip known as the 8259 programmable interrupt controller (PIC). When the PIC receives an interrupt request, it determines its level of importance in relation to the other signals it's receiving, then issues an interrupt to the processor. At the same time, it tells the processor the number of the IRQ line on which the interrupt request originated.

A single PIC can juggle as many as eight requests at one time. System vendors can link additional PICs for more interrupt numbers in a process called cascading (see "Cascading Hardware IRQs," page 232). The PC and PC-XT both use a single PIC. The PC-AT and compatibles cascade two PICs to provide up to 15 distinct interrupts.

The PIC prioritizes interrupt requests according to the IRQ line on which they arrive. IRQ 0 has the highest priority: It's the system timer. IRQ 1, which handles the keyboard, has the second-highest priority. Each IRQ line, down to IRQ 7, has successively lower priority. Thus, if simultaneous interrupts arrive from the COM2 port (associated with IRQ 3) and the COM1 port (associated with IRQ 4), the processor will service COM2 first.

In AT-compatible systems, a second PIC handles 16-bit expansion boards on IRQ 8 through IRQ 15. The second PIC's interrupt signals run through IRQ 2 on the first PIC rather than connecting directly to the processor. That means that IRQ 8 through IRQ 15 (signaled on the IRQ 2 line) have a higher priority than IRQ 3 through IRQ 7.

IRQ Politics

If you install enough boards, a conflict is inevitable. Fortunately, the state of IRQs is improving. Many peripherals can share a hardware interrupt if certain conditions are met. For some peripherals, this can be as simple as ensuring that only one device is using the interrupt at a time. Other times, however, interrupt sharing is impossible. Some network boards simply will not work properly if configured to use IRQ 3 and if COM2 is also present in your system. (Because most software automatically assumes that COM2 is using IRQ 3, you'll have to change the conflicting network adapter.)

In the near future, developing standards may provide boards that automatically configure themselves. Meanwhile, you're still the final arbiter of your PC's IRQ resources. Forewarned is forearmed—understanding how IRQs work is half the battle. ◤

Robert L. Hummel is the author of several technical references for Ziff-Davis Press. You can reach Hummel on CompuServe at 72241,2222 or by writing him at PC/Computing, 950 Tower Lane, 19th Floor, Foster City, CA 94404.

STANDARD IRQs

To help you decide how to allocate your IRQs and predict conflicts, here's a quick overview of their standard use:

IRQ	What it Does
0	System timer.
1	Keyboard.
2	Usually available for use by expansion boards.
3	COM2, COM4, network adapters, CD-ROM adapters, and sound boards.
4	COM1 and COM3.
5	LPT2 parallel port.
6	Floppy disk controller.
7	LPT1, but rarely used.
8	Real-time clock.
9	Same as IRQ 2.
10	Available.
11	Available.
12	Available.
13	Math coprocessor.
14	Hard disk controller.
15	Available.

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F770i-W	21"	0.26mm	H:45-106kHz V:55-120Hz	1600x1200
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INSIDE THIS MONTH

Check for viruses automatically • View PCX files from DOS • Get the most from high-res screens • FCBs explained

Automatic Virus Check

Is there a way to run an automatic virus check every time you change drives using MS-DOS 6's MSAV on a floppy disk? As a quick and easy solution, a coworker added the following two DOSKEY commands to his AUTOEXEC.BAT file:

```
doskey a:=c:\dos\msav /c /n a:$T
  a:
doskey b:=c:\dos\msav /c /n b:$T
  b:
```

He would like to be able to do the same thing in Windows, but we haven't been able to come up with anything. Is there any way to do this, or will we need to purchase additional software?

DJENO JEAN-ROMAIN
BROOKLYN, NEW YORK

There is a variety of shareware and commercial anti-virus products on the market today, but included with MS-DOS 6 is one of MSAV's best features: VSAFE. It prevents viral infection in the Windows environment without using the DOSKEY macros.

You load VSAFE from your AUTOEXEC.BAT file. Depending on how you configure it, VSAFE constantly checks for a variety of virus activities, including:

- Formatting of disks, both hard and floppy
- Boot sector viruses
- Modification of executable files
- Attempts to overwrite the boot sector and partition tables.

In order to fully protect your system with VSAFE while using DOS and Windows, perform the following steps:

1. Add VSAFE to your AUTOEXEC.BAT file. Be sure the DOS directory is in your PATH so that VSAFE can find the MWAV.INI file. You'll need to reboot to enable it.

2. From DOS, press ALT-V to open the VSAFE dialog box. Then you can edit the settings for the options you want to enable automatically. (Information about the options available can be found in your MS-DOS 6 User's Guide on page 73.)

3. Make a copy of WIN.INI, then edit it with any text editor and add the line load=MWAVTSR.EXE in the [Windows] section. This program must be in your DOS directory for MWAV, the Windows version of the Anti-Virus utilities, to load properly. If it's not there, you'll need to rerun the MS-DOS 6 SETUP program and install it. (*Caution:* You'll need to unload VSAFE from memory before running SETUP. Press ALT-V and then press ALT-U to unload VSAFE. You'll need to Reboot after running SETUP to re-enable VSAFE.) Once MWAVTSR is loaded you'll have an icon called TSR manager in the Program Manager. Double-click on it to configure your Windows protection.

With all these steps completed, you should now be able to protect your system automatically against viral infection in both operating environments.

High Res without Tiny Fonts

I just acquired a new Zenith 486DX/33 system, with a display adapter that is supposed to be capable of 1,024-by-768 resolution at 256 colors (1,024 by 768 by 256), for my 14-inch color monitor. I changed the monitor setup in Windows from 640 by 480 to 1,024 by 768, but when I restarted Windows, the fonts and icons were much too small. How can I increase the size of the icons and buttons in both Windows and Windows applications and still take advantage of my screen's inherent high resolution?

KEVIN L. REED
TROY, NEW YORK

Although your 14-inch monitor and video adapter are indeed capable of displaying the higher 1,024-by-768 resolution using 16, 32, 64, and 256 colors, you've found out that the high-resolution settings cause the world to take on a much different look: small and fuzzy.

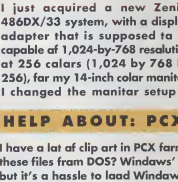
I've run into the same problem with my 15-inch monitor. Try using the SVGA 800-by-600 video driver provided with Windows instead of the higher resolution 1,024-by-768 video driver. You'll find it much easier on the eyes. It's worked very well for me.

For more information on how video drivers work in Windows, check out pages 222 to 226 of our November 1993 Windows Superguide. We discuss various resolutions for different monitor sizes. Most 14-inch monitors

HELP ABOUT: PCX FILES IN DOS

I have a lot of clip art in PCX format. Is there a program I can use to view these files from DOS? Windows' Paintbrush is excellent for viewing them, but it's a hassle to load Windows just to view a file.

BRIAN FAIR
JACKSONVILLE, FLORIDA



We found a shareware program that is entirely DOS-based and will let you do a whole lot more than just view PCX files. View, convert, reverse, rotate, flip, scale, and crop your images with Graphic Workshop by Alchemy Mindworks (905-729-4969). And there's even more to this tidy all-in-one, configurable program—check it out by downloading GWSHOP.ZIP from the PC/Contact forum's data library 3 (Utilities/Misc.).

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using 640-by-480 VGA resolution, for example, will display the Program Manager full-screen with very easy-to-read type, while larger monitors (17-inch and larger)—with the right adapter—can take better advantage of the higher 1,024-by-768 SVGA and XGA settings without creating minuscule icons and display fonts.

FCBs Explained

I recently upgraded to MS-DOS 6.0. Everything went smoothly, and I decided to use the Memory Maker utility to take advantage of some of the new DOS features. After MemMaker ran, I noticed a new line in my CONFIG.SYS file that said FCBS=4,0. In simple English, what are FCBs and where are they used? What effect da they have an the system?

JOHN F. CINATL
CLOVIS, CALIFORNIA

File Control Blocks are a holdover from the old MS-DOS 1.0 days and they provide backward compatibility. FCBs are merely an internal holding pen (reserved memory for caching) for data about concurrently open files. In newer versions of DOS, FCBs have been replaced with File Handles. However, old applications still need FCBs. Some new applications such as Central Point's PC Tools, Quarterdeck's QEMM-386, and Symantec's Norton Utilities and Norton Desktop set FCBs on install in case old DOS applications that still require them are lurking on your hard disk.

Each time you open a file or program that uses FCBs, the program copies a code and the filename to an open FCB. After the FCB is in place, when you open the same file or program a second time, DOS can read and access the code and filename quickly. DOS also updates the FCB as the file or program changes (for example, if you update the file, the date-and-time stamp changes).

FCBs can range from 1 to 255, with a default of 4. Since most programs today don't rely on FCBs, you can effectively conserve a little RAM by setting FCBS=1 in CONFIG.SYS. If you load a program that says it can't open a file, increase this value, reboot your computer, and try again to see if the error goes away.

Slow-Motion DOS Applications

Every time I try to run a DOS application in Windows, the program behaves as if it's in slow motion. Is there any way I can speed it up and still run it in a window?

RAYMOND E. HURT
CENTER TUFTONBORO, NEW HAMPSHIRE

That depends. There are many causes for slow system performance with DOS applications in Windows. Here are five of the most common bottlenecks, but we've barely scratched the surface of potential problems:

1. Slow hard disk drive. If your hard disk drive is older, with an average access time of 40ms to 70ms, replace it with a newer IDE drive capable of access times of 12ms or less.

2. Insufficient, nonexistent, or improper swap-file size. If you're using a small swap file—or no swap file at all—Windows is spending too much time swapping to and from the small swap file. If you're *not* using a swap file, Windows may be spending too much time moving data into and out of memory, causing a degradation of system speed and overall performance. If you're using a temporary swap file instead of a permanent (or no) swap file, the system may be

CHALLENGE SOLVED

In the November issue, we challenged you to come up with batch files for running certain commands once a day—when you first booted your computer, but not subsequent times. Many readers provided similar responses, some of which included the use of Chris DeVoney's DOONCE Utility (see "Get Your PC Chores Done Once a Day, Every Day," June 1991, page 236). But none was as simple and sweet as the tip provided by Lex Thomas of Charlotte, North Carolina. You can find Mr. Thomas' batch file solution online on PC/Contact as NEWDAY.ZIP (Hot Tips/Secrets, in library 1).

With the edits at the bottom of this column, your AUTOEXEC.BAT file can use NEWDAY.BAT to create an environmental variable called NEWDAY. AUTOEXEC.BAT checks NEWDAY to see if you're booting your computer for the first time that day. In the following example, we run CHKDSK once a day, but it could easily be modified to run any command you wanted.

If you're using MS-DOS 5, NEWDAY.BAT requires the MS-DOS program File Compare (FC) and the program FIND. Both files must be in your PATH. Open any text editor and enter the following lines to create NEWDAY.BAT:

```
REM Program name is NEWDAY.BAT
@ECHO OFF
SET NEWDAY="NO"
ECHO. | DATE | FIND "C" > TEMPBOOT.TXT
FC TEMPBOOT.TXT LASTBOOT.TXT | FIND "no diff" >NUL
```

Note: If you're using MS-DOS 6 or later, replace the above line with the following line:

```
ECHO N | COMP /A TEMPBOOT.TXT LASTBOOT.TXT | FIND "no diff" >NUL
IF EXIST LASTBOOT.TXT DEL LASTBOOT.TXT
RENAME TEMPBOOT.TXT LASTBOOT.TXT >NUL
IF ERRORLEVEL 1 SET NEWDAY="YES"
```

Save this file as NEWDAY.BAT in your root directory. NEWDAY.BAT leaves a file called LASTBOOT.TXT in your root directory containing the time you last booted your computer. You can easily move LASTBOOT.TXT by changing the ECHO line above. Now edit your AUTOEXEC.BAT to include these lines:

```
CALL NEWDAY
IF %NEWDAY% == "YES" CHKDSK
```

Place your once-daily routines where we have CHKDSK. For best results, place these lines near the top of AUTOEXEC.BAT—after the PATH statement, but before anything else.

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running slowly because of file fragmentation on your hard disk. Change the swap file from temporary to permanent for a performance gain.

If you're not running multiple applications, you may not need a swap file at all. Depending on the amount of RAM installed and the types of applications you're running simultaneously, many systems suffer a performance loss when using a permanent or temporary swap file. Experiment with both settings and see which is best for you.

3. Improper SmartDrive configuration. SmartDrive does not have a large enough initial cache size (Microsoft recommends 512K). On a 2MB system, SmartDrive should be configured for an initial cache size of 1MB and a Windows cache size of 256K.

4. Too many TSRs and device drivers loaded into conventional memory. If you load several TSRs and device drivers into expanded memory, you may run out of upper memory blocks (UMBs). As a result, some of the TSRs and drivers will load into conventional memory. This reduction in conventional memory affects Windows performance because each virtual machine (DOS application, for example) inherits the parent environment (everything that loads in your AUTOEXEC.BAT and CONFIG.SYS files). Reduce the number of TSRs loaded in your startup files and maximize your UMB usage through MS-DOS's MemMaker utility (or a compatible memory manager utility such as Manifest from Quarterdeck) to increase conventional memory.

5. Incorrect PIF settings. Your program information files (PIFs) may be hampering the application's performance. Settings on the Advanced Options screen in the PIF editor could affect the application's performance, especially the multitasking, memory, and display options. Most software vendors provide PIFs optimized for their applications. Use vendor-supplied PIFs when they're available.

If you have access to CompuServe and ZiffNet online, use the PC/Contact forum to talk with other users and the magazine editors about specific configuration issues. In addition, the Microsoft Windows Resource Kit can be purchased directly from Microsoft and contains a wealth of information for both novices and experienced computer users about configuration and troubleshooting the Windows operating environment. ◪

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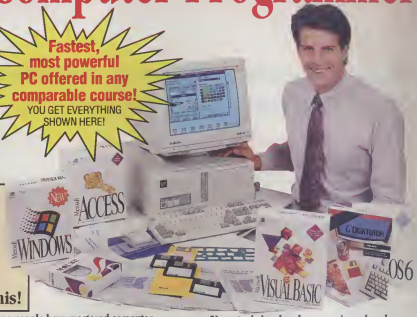

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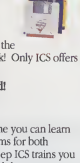

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X10

Don't Leave Home without Your Network's Number

Tips for making computing life on the road faster, easier, and more secure.

You're on the road. Your presentations, spreadsheets, e-mail, and schedule are in your office. Fortunately, you thought ahead and set everything up so you can dial in from the road. But no matter how you're set up for remote access, you've probably noticed that it's slow. Here's how to make it fast.

There are two ways to access a network from the road. The first is called *remote control*, in which you dial in and grab control of a system that's on the network using software such as the Norton pcAnywhere. The second approach, called *remote node*, allows you to dial in to a gateway that actually makes your notebook computer a network node. Products in the second category include Shiva's NetModem\E.

No Matter Which You Choose

Put another way, remote node products turn your desktop PC into a puppet and your notebook computer into the puppetmaster. The remote node software sends screenfuls of information from desktop PC to notebook over a modem line. By contrast, remote access products give your notebook the same access to the network that your desktop PC has—except there's no desktop PC back at the office that you're controlling. Your notebook is a network node.

When you're working away from the office, you also have two choices when it comes to running your applications: leave them at work on the server or pack them onto your portable's hard drive. Both have pros and cons. The best reason for taking your applications on the road is performance: Even over a compressed 9,600-bps line, watching Lotus Freelance Graphics repaint the screen can be *painful*. So you want all your applications on your notebook, right?

Hold on to your lawyers, folks. The biggest reason not to take applications on the road is that by doing so you may be in violation of your software's license agreement. Some network software is licensed by server; other software is licensed on a per-node basis. In either case, you are authorized to run only a certain number of copies of the software. When you run an application from the server while connected to your desktop via modem, you are running the authorized network copy. If you want to put a copy of your favorite word processor on your notebook in preparation for the next road trip, you have to make sure that the license agreement allows this.

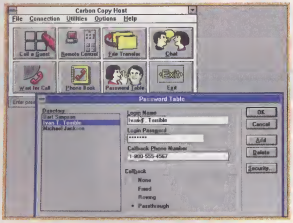
One of the biggest problems with having one computer for the road and another for your office is that the files on one computer will be out of synch with the files on the other. You need a good, reliable way to make sure you're always using the most recent versions.

Products such as Microsoft's Interlink (which comes bundled with DOS 6) make transferring files between two computers via the parallel port a breeze, but they don't keep track of which documents are more recent. For that you need a product such as Traveling Software's LapLink V, which automatically reconciles the directories of two PCs and also provides you with a serial cable.

Remote Control

After you've decided whether to keep your applications on the network or take them with you, you're ready to hit to road. If you choose to go with remote control software, watch for these sharks in your pond:

- Monitor resolution. If your notebook's monitor has a lower resolution than the PC it grabs control of, it's likely to display only a portion of the PC's display. Many remote access packages can't handle resolutions higher than 800 by 600 pixels, and the performance hit you take for running even that resolution can be high. Stick to VGA if you can.



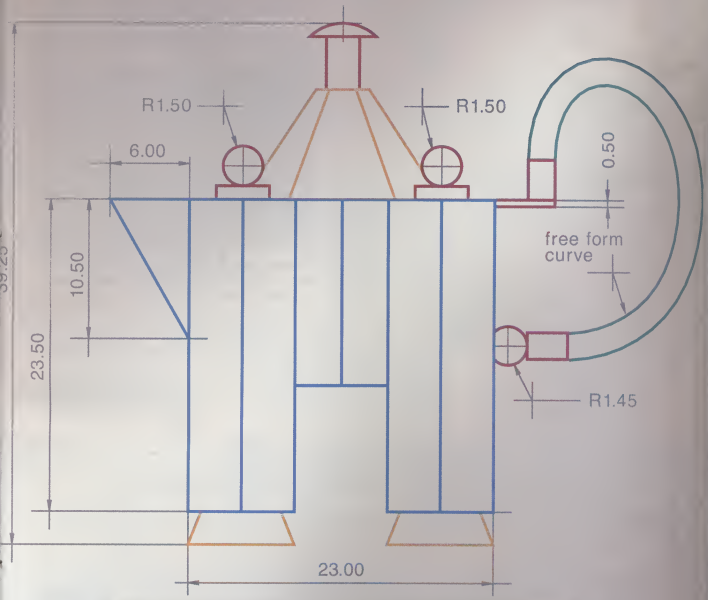
Microcom's Carbon Copy for Windows allows you to increase your host system's security by setting it so that it calls you back only at predetermined phone numbers.

NET APP OF THE MONTH

BindDel

Many products create objects in the NetWare Bindery upon installation. NetWare might use these objects to enforce licensing or hold operating parameters. If you stop using the product, you may have no way of getting those objects out of the Bindery. BindDel takes care of this problem. Keeping the number of objects low makes it easier to track security infractions. Download BINDDEL.ZIP from PC/Contact's data library 3 (Utilities/Misc.), or turn to page 18 to order it on disk from Public Brand Software.

PC/Contact



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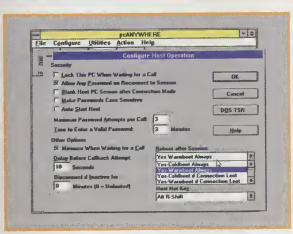
• Driver replacement. Remote control software almost always replaces your default Windows mouse, keyboard, and display drivers with proprietary drivers. Well-designed software will make backup copies of your INI files. Just to be safe, make backup copies of the originals. If you decide to remove the remote control software, be careful to replace your original INI files *before* removing the remote control software's drivers. If you don't, you probably won't be able to load Windows.

Windows reads the SYSTEM.INI file to find out which drivers to load for the keyboard, mouse, and display. If you've deleted the drivers and you haven't restored the SYSTEM.INI file, Windows will come to a screeching halt. Even if you restore the original SYSTEM.INI files, your Windows directories will still have the remote control drivers. It's not wise to delete any file with the DRV extension (unless you're absolutely certain that you won't ever need it again). So, if you really want to make sure you don't accidentally delete some important drivers, look for remote control software that has an uninstall feature.

Symantec's The Norton pcAnywhere. One of the most popular remote control packages is pcAnywhere. Here are two tips to make it sing. First, set up your host PC (the one you're dialing in to) to reboot on disconnect—this makes the PC ready for the next call. Now set the host's Windows wallpaper (under the Windows Control Panel's Desktop) to None; wallpaper requires a lot of bandwidth to transmit.

Norton-Lambert's Close-Up. I've found that by default Close-Up takes a lot of memory, but it's relatively simple to turn it down. Run CHOST, the remote control software on your notebook, like this: CHOST SMALL BUFFERS=S. That will push you from a default of about 81K down to about 47K. And if you want to run CHOST with a memory manager, you need to reduce its disk size before



The Norton pcAnywhere allows you to set your host to reboot after you disconnect. If there is a problem with the host, you can disconnect, then call back to a host that's been reset.

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VACANCY

Quarterdeck

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Quarterdeck International Ltd., B.I.M. House, Crofton Terrace, Dun Laoghaire Co. Dublin, Ireland Tel.(353) (1) 284-4444 Fax: (353) (1) 284-4380

Now we got the chart translation CPU—486/33 ALR Power/business VESA machine equipped with 16 mega of RAM and running MS-DOS 6. Competitors were close enough the following memory managers: QEMM 5.99, MS-DOS 6 MemMaker. In addition to the drivers for drivers required by each memory manager, the following drivers, DOS resources and programs were loaded for all comparisons. In the CONFIG.SYS file: SETVER.EXE, DOS=HIGH, FILES=30, BUFFERS=30, STACKS=8,8, MOUSE=NUL, SYS, DEVICE=ANSI.SYS, SLCD.SYS, DOS=NUL,c:\stationery, in the AUTOEXEC.BAT file: WAKE, MSCDEX, LINEDLETE, DIL, LOM, NEOM1.COM, IPXODI.COM, NETX.OR EMSNETX, MOUSE.COM, SMARTDRV.COM, PROCLAP.COM ©1993 Quarterdeck Office Systems. Trademarks are property of their respective owners.

you load it. Just type: CHOST EXTRACT SMALL in the Close-Up directory, and you'll produce a version of CHOST called CHOSTS.EXE that's about 55K (compared with the default of about 260K).

Shiva's NetModem\E. Let's look at some ways to make one of the remote node products on the market—Shiva's NetModem\E—really fly. Let's skip the really obvious ones (buy fast modems, keep your applications on your portable PC). Here are some others.

When you're accessing your e-mail, remember two things. First, it will take a lot less time to grab e-mail if you keep your in-box as empty as possible. In other words, after you read messages, file them into another folder. And second, creating messages while online can be expensive. Look for an e-mail package that allows you to create your mail offline. If you can't find one you like, create your e-mail messages offline in a word processor, then dial in, and cut and paste your prepared messages into the e-mail package.

Novell's Access Services. Novell's Access Services doesn't give you the full network access of remote control or remote node configurations, but if you need to access only the files on your NetWare server, Novell's Access Services is one way to do it. To boost the access server's speed, disable VGA graphics on the access server. When you dial in to the Novell access server, you're grabbing control of the access server's screen. If the access server's video is set to run in VGA mode, switch it to CGA. Your applications will run only in character mode, but they'll run considerably faster. You'll also free up 130K of RAM in your session.

Miscellaneous Traveling Gear. When traveling, be sure to take a phone cable with RJ-11 connectors with you.

Buy the fastest modems you can afford—preferably those built around a standard transmission and encoding scheme. Most BBSes can connect at speeds no higher than 9,600 bps, but when you can use V.32/V.42bis or V.Fast you'll appreciate it.

Get a modem with two phone jacks. That will allow you to use the phone without unplugging the modem. If you can't find one, use a Y-jack, a Y-shaped device with one end that plugs into the wall jack. The Y-jack essentially splits the single phone line into two lines: one for the phone, the other for the modem.

Also, think about getting a modem that performs automatic hang-ups. You'll find this an important feature if you ever lose your modem connection. The modem will automatically disconnect from the phone line; without automatic hang-up, it will stay off the hook, preventing you from dialing in again until you reset the modem.

Jef Rand is a network industry analyst. Send comments to Help, *PC/Computing*, 950 Tower Lane, 19th Floor, Foster City, CA 94404.

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The Nuptials of the Century: Excel Weds Word for Windows

Second of two articles explaining how to use OLE Automation.

Hey, Paw! Go getcher shotgun! We got Excel an' Word for Windows here, an' they's fixin' to git hitched! Yeah, they's cousins, but what the hay. We's too late anyway. This here hacker guy says they already got a young'n. Named him Mort. He's ugly as two cowpies floatin' in rind stew, but he's kin so we gotta do what's right. I'll go fetch Reverend Ollie an' meetcha in Chicago.

In last month's Toolkit column (page 252), we built Mort, a five-line Excel 5.0 for Windows program to calculate and display mortgage payments. Along the way, you had a chance to get your feet wet with the Excel dialect of Visual Basic for Applications (VBA).

This month we're going to make Mort jump through an extraordinary hoop: print a little report in Word 6.0 for Windows. Mort—an Excel program—will use OLE Automation to directly manipulate the innards of Word for Windows. All this magic comes from the two bonestock products; if you have Excel 5.0 and Word for Windows 6.0 installed, you have everything you need to tie the two together, and you can do it right now.

There's lots of techie stuff lurking in the background of this conjoining, but the basic idea is actually pretty easy: OLE Automation sets up things so one Windows application can control another. Visual Basic, for example, can take control of ShapeWare's Visio. Or Excel can ring Word for Windows' chimes. Directly. You'll see how in a minute.

OLE Automation

Unfortunately, OLE Auto applications have to be built specifically to conform to OLE Auto's way of working. You can't pick any odd WinApp off the shelf of your local software store and expect it to do the OLE Auto shtick. At this moment, most major Windows application manufacturers are scurrying around trying to get OLE Auto grafted onto their applications, and for good reason. It's enormously powerful—so much so that it's the future of Windows programming, as far as we're concerned.

In any OLE Auto setup, one application controls things, and the other dances to the controller's tune. Think of a puppeteer and puppet. We call the application that pulls the strings a "client," and the subservient one a "server." (Microsoft calls them "container" and "object." Why? Why is the sky blue?)

As of this writing, only two applications are capable of being OLE Auto clients: Visual Basic 3.0 and Excel 5.0. At least three major applications can be OLE Auto servers: Excel 5.0, Word 6.0 for Windows, and Visio 2.0. Each implementation has quirks that a more cynical person might call bugs. You'll come to appreciate the quirks and oddities as you delve deeper into the implementations.

We've set up Mort to use Excel as an OLE Auto client and Word for Windows as an OLE Auto server. That's quite intentional: Of the available client-server combinations, it's the pair you're most likely to have running on your machine.

Let's start by creating a Word for Windows template—that's what Word for Windows calls a prototype of a document. Crank up Word for Windows, click on File, New, then make sure the Template button in the New box is checked, and click OK. You'll see a brand-new, blank sheet of paper, and the window title will tell you it's called Template1.

Your new template deserves a name, so click File, then Save, and type in something witty. Mort will do. Click OK, and your new template will be called MORT.DOT; it will be located in Word for Windows' template directory, typically C:\WINWORD\TEMPLATE.

Mort Lives

Now you can play with the template to make it look spiffy. We battered things around a bit, and stuck in a company

OLE AUTOMATION WITH EXCEL 5.0

Here's the program that actually runs Word for Windows from within Excel. In the Mort workbook you put together in last month's Toolkit column (page 252), flip to Module 1, and type the following program:

```
Sub PrintFormLetter()
CalculateMonthlyPayment
Set OhWord = CreateObject("Word.Basic")
OhWord.FileNew "mort.dot"
OhWord.EditGoto "Amount"
OhWord.Insert DialogSheets("Mort").EditBoxes("Amount").Text
OhWord.EditGoto "Rate"
OhWord.Insert DialogSheets("Mort").EditBoxes("Years").Text
OhWord.EditGoto "Years"
OhWord.Insert DialogSheets("Mort").EditBoxes("Years").Text
OhWord.EditGoto "Payment"
OhWord.Insert DialogSheets("Mort").Labels("Payment").Text
OhWord.FilePrint
OhWord.DocClose 2
Set OhWord = Nothing
End Sub
```

Think

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2	Auto Lab	280 Congress St.	Troy	555-2846	M,T,W 10-6; Th-Fr 10-5
3	Radio Shack	110 Waterfront Ave.	Waterfront	555-1125	M,T,W 10-6; Th-Fr 10-5
4	Lechmere	89 Federal Way	Albany	555-7327	M,T,W 10-6; Th-Fr 10-5
5	Jaime's Auto	310 State Street	Albany	555-4520	M,T,W 10-6; Th-Fr 10-5
6	A.J.'s Wallmart	67 Third St.	East Greenbush	555-5031	M,T,W 10-6; Th-Fr 10-5
7	Hippo's	1300 Central Ave.	Albany	555-5038	M,T,W 10-6; Th-Fr 10-5
8	K-Mart	80 Washington St.	Rensselaer	555-1519	M,T,W 10-6; Th-Fr 10-5
9	Kinney	Village Plaza, Rt. 146	Schenectady	555-8047	M,T,W 10-6; Th-Fr 10-5
10	Grover's Stereo	76 O'Brien Way	Loudonville	555-4230	M,T,W 10-6; Th-Fr 10-5
11	Quicker's	1423 Reach Dr.	Albany	555-1587	M,T,W 10-6; Th-Fr 10-5
12	Coor's	Northern Plaza, Rt. 152	Albany	555-2021	M,T,W 10-6; Th-Fr 10-5
13	Dalton Stereos	130 Ontario Street	Troy	555-1473	M,T,W 10-6; Th-Fr 10-5
14	Crossroad Audio	1989 Railroad Ave.	Albany	555-8200	M,T,W 10-6; Th-Fr 10-5
15	Radio Shack	872 Johnson St	Watervliet	555-8711	M,T,W 10-6; Th-Fr 10-5
16	K-Mart	89 Albany Street	Albany	555-2205	M,T,W 10-6; Th-Fr 10-5
17	Hippo's	45 Wadsworth Circle	Menands	555-4099	M,T,W 10-6; Th-Fr 10-5
18	Sam's Club	870 Central Ave.	Albany	555-7159	M,T,W 10-6; Th-Fr 10-5
19	Audio Lab II	1145 Lasher Ave.	Albany	555-4049	M,T,W 10-6; Th-Fr 10-5
20	Wilson Stereo	189 Central Ave	Albany	555-4893	M,T,W 10-6; Th-Fr 10-5
21	Dolder's	40 Branch St	Colonie	555-4606	M,T,W 10-6; Th-Fr 10-5
22	Bettig's Stereo	2764 Consent Rd.	Schenectady	555-8424	M,T,W 10-6; Th-Fr 10-5
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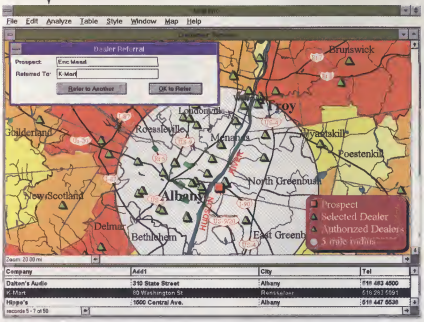

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name and date (click Insert, then Date and Time, pick a format you like, and make sure the Insert as Field box is checked). The result of our mindless rattling is shown in the screen below.

Mort, the Excel program, will need bookmarks in MORT.DOT, the Word for Windows template, so it'll know where to stick the data. We'll put four bookmarks in MORT.DOT, one for each piece of data Mort handles.

Inside MORT.DOT, put your cursor immediately after the first dollar sign. Click Edit, then Bookmark, type in a name—say, Amount—and hit Add. You now have a bookmark called Amount located right after that dollar sign.

Using the same method, add a bookmark called Rate in front of the percentage sign, one called Years in front of the word *years*, and one called Payment after the final dollar sign.

See what we're getting at? We're designating the places in the form letter where Mort should put its data. And it's really just this simple.

OK. Save everything, then quit Word for Windows. Take a deep breath. The fun part is over. It's time to get down to work and write your (shudder) program.

The Program

Bring up Excel, and retrieve the Mort workbook you put together last month. (You did save it, didn't you?) Using the tabs at the bottom of the screen, flip over to the Mort dialog sheet. Click on the rectangular button in the Forms box—the one you use to create a push-button control—then put a new push-button at the bottom of the dialog. Type in, oh, "Print Form Letter." Mort's pretty face should now look like the screen at right.

We're ready to write the code—another real Windows program. Are you sufficiently intimidated? Beads of sweat pouring down your face? Good. You're in the right mood.

Click on that Print Form Letter button with your right-mouse button, scroll down to "Assign Macro," and let go of the button. Type in a good name, say, PrintFormLetter. Click OK.

Flip back into Module 1, and type in the program that's displayed in "OLE Automation with Excel 5.0," page 252. Let's go through it, slowly.

First, calculate the monthly payment. We could've duplicated all the code in the CalculateMonthlyPayment subroutine you wrote last month, but why bother? We can call the same subroutine from right here; and as a nice lagniappe that old routine will update the Payment label—the monthly payment amount—in Mort's dialog. Righteous.

Now comes the voodoo. That Create Object function is what builds the link between Excel and Word for Windows. Although it has a terrible name (we can just hear the object-oriented programmers shudder!) this little hummer finds Word for Windows out in the Windows Ooze, kick-starts it, and then sets up everything necessary to start communicating with WordBasic, inside of Word for Windows. It's a very powerful function, indeed: quite possibly the most powerful, most complex Basic command ever implemented. It's at the core of OLE Automation.

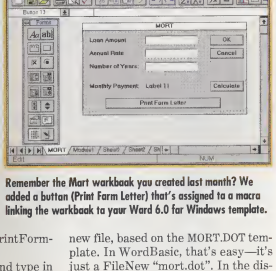
Once that Create Object function is done, any time you refer to the "object"—we called it OhWord, but we could've called it anything—your Excel VBA commands are actually run by Word for Windows.

The next line provides a juicy example. We want to create a new file, based on the MORT.DOT template. In WordBasic, that's easy—it's just a FileNew "mort.dot". In the distant past (oh, three or four months ago), it took a whole lotta hackin' to get Excel to reliably create a new document in Word for Windows. Now, with OLE Auto, it's easy: As long as you preface the command with the name of the Word for Windows object (OhWord in this case), WordBasic programming inside Excel looks a whole lot like WordBasic programming inside Word for Windows!

The next eight lines simply hop through the new document, inserting the appropriate stuff in the appropriate places. Word for Windows prints the document, and you're ready to start again. The last line relinquishes control of Word for Windows.

That's all it takes. Save everything. Then jump over to the Mort dialog, push the lower-right button in the Forms box to start things, and fire away!

You're on your own now, pilgrim. Go ahead and play around. But remember to save often and save well—and don't be surprised if you hit something that looks mighty screwy. This is still largely uncharted "Version 1.0" territory, and the official documentation is a mess. Fortunately, there should be a few books out shortly that'll help.



Remember the Mort workbook you created last month? We added a button (Print Form Letter) that's assigned to a macro linking the workbook to your Word 6.0 for Windows template.

MORTimer's Nerd Mortgage Company¶
You get the credit — We get the bucks™ ¶

¶
April 11, 1994¶

¶
Dear Sluckee ¶
¶
Congratulations! Your mortgage application has been approved. We would like to take this opportunity to welcome you to the seventh ring of Jeffrey's hell. you will be sharing most of your life to make payments on a mediocre piece of trash that cost you ten times what it's worth. We hope you find the joys of home ownership to be commensurate with the cost. ¶
¶
Loan Amount $ ¶
Annual Rate %¶
Term of Loan: years¶
¶
Monthly payment: $ ¶
¶
Yours truly,¶
Fake Signature¶¶

MORT.DOT: Using a Word 6.0 for Windows template such as this one, you can create a home for all the information you generated in last month's Excel program—Mort.

Nope, neither Woody nor Vincent will be writing those books. Got a problem? Harass the duo mercilessly on ZiffNet's *PC/Computing* forum, GO ZNT:PCCONTACT. Contact Woody Leonhard at 72241,2125 and Vincent Chen at 76636,415.

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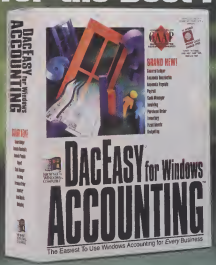

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Inside Spec Watch

Slide in some RAM, a 64-bit Windows accelerator, and a stereo-quality sound card to keep up with this month's advances.

Ta-da! Windows' familiar multimedia greeting makes business presentations come alive. That's assuming that you have a decent sound card, of course. The tinny models produced even three years ago can't compete with today's standard. This month's Spec Watch shows you how to find a card that will make your PC resound with symphonic exultation. Other trends to watch:

- **The RAM Drought Is Over**
  Sort of, anyway. Four-megabyte SIMMs now cost about one-third less than they did during last summer's shortage. Most analysts predict prices will hold steady through the end of 1994. Now's the time to upgrade if you've been holding off.

- **Flash BIOS for Future Plug and Play**
  Even if your system doesn't come with a Plug and Play BIOS, you may want this capability down the road. Your best safeguard? Flash BIOS. Make sure the system you buy has one.

- **Print Faster Color Now**
  Stop drumming your fingers. Better thermal transfer printers now produce color pages at 2 pages per minute (ppm), instead of the industry-standard 1 ppm. Because the printer lays a primer coat on the page to prevent bleeding, pages dry fast and emerge quickly.

- **Blasting 64-Bit Video**
  They keep getting faster: 64-bit accelerator chip designs from ATI, S3, Matrox, and others are edging out first-generation accelerators. For the absolute best video performance, look for a VRAM-based accelerator built around chips such as the ATI 68800AX (Mach64), S3 Vision964, or Matrox MGA.

By Marty Jerome

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Stereo-Quality Sound Cards Give Voice to Multimedia Applications

Look for wide compatibility, a DSP, and 16-bit recording.

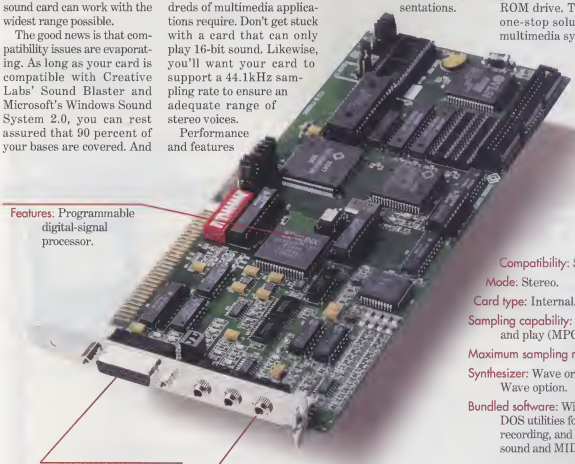
Let wiser voices be heard. Truly interactive applications require audio—music, voices, and sound effects—to work in harmony with the visuals your PC presents. But sound cards are evolving quickly, and often unpredictably. As scores of multimedia applications storm dealers' shelves, you'll want to make sure that your sound card can work with the widest range possible.

The good news is that compatibility issues are evaporating. As long as your card is compatible with Creative Labs' Sound Blaster and Microsoft's Windows Sound System 2.0, you can rest assured that 90 percent of your bases are covered. And those applications that work with different sound cards are quickly porting over to one of these two.

After compatibility, your chief consideration will be quality. Better sound cards can both play *and* record 16-bit sound, which is true stereo quality. It's also the MPC 2 standard, which hundreds of multimedia applications require. Don't get stuck with a card that can only play 16-bit sound. Likewise, you'll want your card to support a 44.1kHz sampling rate to ensure an adequate range of stereo voices.

Performance and features are equally important. You should insist that your board includes a digital signal processor for compressing and processing sound. Some cards also feature 3-D QSound Virtual Audio, which creates "wrap-around sound" similar to the stereo in a Lexus. It gives an unbeatable realism to business presentations.

Finally, your card should have enough ports. At a minimum, you'll want speaker and microphone jacks. Better sound cards also come with a joystick port, for the very rare occasion that you'll want to play a multimedia game. And some cards even feature a SCSI port for connecting a CD-ROM drive. This provides a one-stop solution to a true multimedia system.



Compatibility: Sound Blaster.

Mode: Stereo.

Card type: Internal.

Sampling capability: 16-bit record and play (MPC 2 standard).

Maximum sampling rate: 44.1kHz.

Synthesizer: Wave or FM with Wave option.

Bundled software: Windows and DOS utilities for playing, recording, and editing digital sound and MIDI files.

Red flags: *Cards that play but can't record 16-bit sound or have proprietary (non-SCSI) CD-ROM interface may be less useful.*

Don't settle for less than these specs:

Network Servers

CPU: Intel Pentium, 486DX2/66, or 486DX/50.

RAM: 16MB expandable to 64MB.

CPU RAM cache: 256K.

Display: 14-inch Super VGA color or monochrome.

Video card: Super VGA with 512K of RAM.

Hard drive: 1GB SCSI-2.

Drive bays: Two full-height 5¼-inch, two half-height 5¼-inch with front-panel access, two 3½-inch.

Bus: Eight EISA slots, including two VL-Bus slots.

Features and options: RAID-5, DAT backup, uninterruptible power supply.

Other requirements: FCC Class A or better, UL listed.

Red flags: *ISA bus, slotted RAM, and machines without CPU upgrade sockets are less upgradable.*

Desktop Systems

CPU: Intel 486DX2/66 upgradable.

Secondary cache: 256K four-way set-associative.

Memory: 8MB, expandable to 32MB, 36-bit SIMMs.

Hard drive: 230MB or larger IDE.

Video: VL-Bus or PCI Windows accelerator, 15-inch monitor or larger with 72Hz refresh at 1,024 by 768 pixels.

Slots: Eight ISA slots for full-size case (including two VL-Bus or PCI), three ISA slots for small-footprint case with integrated VL-Bus or PCI video and drive.

Drives and bays: One 3½-inch 1.44MB and one 5¼-inch 1.2MB floppy drive, five half-height 5¼-inch bays.

Red flags: *Pentium-upgradable systems should include CPU, secondary CPU cache, and lots of slots for extra RAM.*

Subnotebook PCs

CPU: 20MHz 386.

Display type: 7½-inch backlit passive- or active-matrix LCD.

Weight: 4 pounds or less.

Size: Under 8¼ by 11 inches.

Keyboard: 90 percent of full-size keyboard.

RAM: 4MB, expandable to 16MB.

Hard drive: 40MB or larger.

Features and options: Removable hard drive, high-speed internal fax modem, integrated pointing device, infrared keyboard connection.

Other requirements: External floppy, at least one Type II PCMCIA slot, small recharger (5¼ by 3 by 1½ inches or smaller).

Red flags: *Subnotebook displays and keyboards entail compromise—try before you buy, or make sure there's a money-back guarantee with no restocking charge.*

Notebook PCs

CPU: 33MHz 486.

Display type: 9½-inch or larger backlit dual-scan passive-matrix or active-matrix color LCD with accelerated local bus.

Weight: Under 7 pounds without AC adapter; total traveling weight under 9 pounds.

Size: Smaller than 10 by 12 by 2 inches.

RAM: 8MB, expandable to 20MB.

Hard drive: 120MB.

Ports/slots: Parallel, 9-pin serial, PS/2 ports; one PCMCIA Type III slot or two Type II slots.

Features and options: Ability to swap out floppy drive for second battery, removable hard drive, user-installable RAM, integrated pointing device.

Other requirements: Standby mode, pop-up battery gauge, 6-by-3-by-3-inch battery recharger.

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RAM: 16MB expandable to 64MB.

CPU RAM cache: 256K.

Display: 14-inch Super VGA color or monochrome.

Video card: Super VGA with 512K of RAM.

Hard drive: 1GB SCSI-2.

Drive bays: Two full-height 5¼-inch, two half-height 5¼-inch with front-panel access, two 3½-inch.

Bus: Eight EISA slots, including two VL-Bus slots.

Features and options: RAID-5, DAT backup, uninterruptible power supply.

Other requirements: FCC Class A or better, UL listed.

Red flags: *ISA bus slotted RAM, and machines*

Desktop Systems

CPU: Intel 486DX2/66 upgradable.

Secondary cache: 256K four-way set-associative.

Memory: 8MB, expandable to 32MB, 36-bit SIMMs.

Hard drive: 230MB or larger IDE.

Video: VL-Bus or PCI Windows accelerator, 15-inch monitor or larger with 72Hz refresh at 1,024 by 768 pixels.

Slots: Eight ISA slots for full-size case (including two VL-Bus or PCI), three ISA slots for small-footprint case with integrated VL-Bus or PCI video and drive.

Drives and bays: One 3½-inch 1.44MB and one 5¼-inch 1.2MB floppy drive, five half-height 5¼-inch bays.

Red flags: *Pentium-upgradable systems should*

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- Includes DOS and Windows software
- Does not come with Alphanumeric display
- Class 1 Fax only
- External only

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EXPERTS' Windows SOURCES PICK

Internal w/ Voice	$129 / $149
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V.32 bis Fax Modem for Windows or DOS

V.32 bis Send/Receive 14,400 Zoom now offers high-speed data and fax with 14,400 bps fax and data. With V.42 bis compression and MNP, these fax/modems can send and receive data at speeds up to 57,600 bps! **Now with DOS fax lite & WIN fax lite!**

Zoom V.FastClass 28.8 bps

NEW!

The Zoom FaxModem VFX 28.8K internal provides an amazing 28.8 thousand bps uncompressed data transmission over conventional telephone lines. The VFX 28.8K uses V.Fast Class transmission protocols to obtain extremely fast data transfer rates and higher connect rates with quicker negotiation than V.32bis at 14,400 bps. **VFX 28.8K Internal** $249

ZoomFaxModem PKT 14.4 Pocket

14,400/V.42 bis Data & 14,400 Fax

Compression to 57,600 bps. Class 1 or 2 send/receive fax with software.

External $189 **w/ Voice Storage/Playback** $265

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Within minutes, you can turn your ideas into precise designs! DesignCAD comes complete with: 500 symbols, dimensioning, drafting and editing toolboxes, materials list, scaling, zoom, layers, and support of 7 file formats.

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- 250ms average access time
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- 256K data buffer

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with SCSI Interface $349

EXPERTS' Windows PICK

535 External

$395

with SCSI Interface $425

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See page 4 for Ordering Information
PCM 3-94

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CD ROM Drive & Interface Options	BARE DRIVE	8 Bit SCSI Interface	16 Bit SCSI-2 Interface	Pro Audio Spectrum 16	Pro Audio Studio 16	Sound Blaster SCSI-2	Sound Blaster SCSI-2 ASP	7 Title MPC Bundle
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Mitsumi FX001D	$199	(with Sound Blaster 16 MPC = $358 or 16 MCD ASP = $394)						add $79
NEC 3Xi Internal	$469	$529	$594	$613	$639	$663	$683	add $79
NEC 3Xe External	$559	$619	$684	$723	$749	$773	$793	add $79
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Prices good with the Purchase of any CD ROM Drive or Upgrade Kit (at time of purchase only)

Add $79 for any 7 title Bundle

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- US Atlas MPC
- World Atlas MPC
- Animals MPC
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Buy 3 for $59 or 5 for $99*

1001 Utilities
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Arthur's Teacher Trouble
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Audubon Mammals
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Carmen World Deluxe
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Gardo
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Jokes & Pranks
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King Quest 5
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Locom
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MacMillians Children's Dictionary
Magazine Rack
Mario is Missing Deluxe
Mavis Beacon 3.0 MPC
Mayo Clinic for Windows
Mixed up Mother Goose
Monkey Island
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Selectwin Jukebox
Software Vault II
Solar System
Sound Effects Library
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Space Shuttle MPC
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Star Wars Chess MPC
Time Table of History
Scenics & Innovation
Tao Mario Typefaces
Toolworks Reli Library
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US Atlas with Automap
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NEC
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3Xi Internal $469
3Xe External $559

TEXEL New!
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w/ NEC 3e Internal **Free Delivery** ..$1,299
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CHINON
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with SCSI Interface, Internal $349
535 Double Speed SCSI II External $385
with SCSI Interface External $425

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Sound Blaster 16 Basic $129
Sound Blaster Deluxe $75
Sound Blaster Pro Deluxe $115
Sound Blaster 16 Multi CD $169
with adv. signal processing $195
Sound Blaster 16 Scsi 2 ..... $179
with adv. signal processing $209

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Pro Spectrum 16 Basic $99
Pro Audio Spectrum 16 ..... $112
Pro Audio Studio 16 ..... $156

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Wave for Windows $74.95
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Aztech Labs Sound Galaxy Basic Extra:
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Logitech SoundMan 16 ..... $109
MS Sound System 2.0 w/ board $179
Diamond Sonic Sound $215
Calypso Audio Magician Plus NEW!..... $79
OgiSpeech Portable Sound+ $145
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Orchid Soundwave 32 ..... $219

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AR Partner 42 Gray $149
AR Partner 570 Gray $279
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Rio Free Delivery $139

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- Optical Resolution: 300 x 600 dpi
- Interface: Parallel
- Software: Image Pal & Alacrity

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AVEC 2400 PC
- Image Data: Same as above
- Optical Resolution: 300 x 600 dpi
- Interface: SCSI-2
- Software: Adobe's Photoshop Full Version

$799

AVEC 4800 PC
- Image Data: Same as above
- Optical Resolution: 400 x 800 dpi
- Interface: SCSI-2
- Software: Adobe's Photoshop Full Version

$989

Reli Single Pass, Flatbed, Color Scanners

Reli 2400 PC
- Image Data: 24bit color, 16.8 million colors, 8bit grayscale, 256 levels, 1bit halftone, 2 levels, 1bit lineart
- Optical Resolution: 300 x 600 dpi
- Interface: SCSI-2
- Software: Adobe's Photoshop Full Version

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- Image Data: Same as above
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Transparency Adapter Included with Both Reli Scanners

Reli 9600 PC

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Ready 425ES, 486 SX25 4MB/170MB $999
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Ready Multimedia 433 CD3, 486 SX33 4MB/250MB Triple Speed $1,879
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Image Pro 60, No Drive, 8MB, 256K Cache, 2MB VRam $2,925
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Force 250, 486 SX/33 4MB/245MB $1,049
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Action Note 4SLC2/50, 4MB/120MB $1,599
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40EC, 40MHz, 120MB / 250MB $3,819 / $4,229
50EC, 50MHz, 209MB / 340MB $4,499 / $4,919

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Megahertz XJ1144 S/R 14 4 $329
Piiceon S/R 14 4 Cellular Comp $329
Supra ComCard S/R 14 4 $299
Motorola S/R 14 4 Cellect $419

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CreditCard Enet 16bit Thin $269
CreditCard Enet 16bit, 10BT $269
NATIONAL SEMI CONDUCTOR
InfoMover NE 4100T, 10BT $219
InfoMover NE 4100MC-1 Coax $219
THOMAS CONRAD
TC 5041-T, 10BT $269
TC 5056T Enet 16/32bit, 10BT $279
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10BT Coax Adapter $279
10BT Removable Cable $299
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CONTROLLERS:
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Star SJ 144 NEW! $469
NX-2450 / NX-2480 $225 / $249

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MicroWriter Basic, 5PPM Laser $509
MicroWriter PS23 5PPM with PS $679
MicroLaser Pro 600 PS23 ($60 Rebate) $1,269*
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Canon
BJ200E / BJ230 Ink Jet $289 / $385
BJ10SX / BJ 600 Color Ink Jet $239 / $575
LBP 430 Laser $585
LBP 860 Laser $1,379

MODEMS

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w/ Voice Int/ Ext $149/$175
Zoom 14 4 PKTExternal $225
with Voice $265
V Fast Class 24 4 bps VFP 24K Int/ VFX 234 Ext $169/$195
V Fast Class 28 8 Internal $249

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SupraFaxModem Internal 24/96 NEW! $53
Supra 2400 External $59
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SupraFaxModem V 32 bis, Internal with FaxSoftware DOS/Win $135
SupraFaxModem V 32 bis, Ext alone $189
with Fax Software, DOS/Win $199
with Fax Software Mac $215
Supra Com Card, PCMCIA, 14 4/14 4, S/R, Free Delivery! $299

USRobotics
Sportster 14 4 Int / with Fax $145 / $149
Sportster 14 4 Ext / with Fax $159 / $169
Courier V 32 Terbo Int / with Fax $325 / $339
Courier V 32 Terbo Ext / with Fax $375 / $389
World Port Dual Standard Celluler Fax PCMCIA Free Delivery $615

intel
14 4 Fax Modem Int/Ext $159/$189

AT&T
14 4 Fax Modem Int/Ext $149/$185
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Backpack Diskette Drive 1.4, 3 5 (Req min DOS 2 0) $175
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ST-251-1 MFM $239
ST-352A / 3102A IDE $115 / $165
ST-3145A / 3243A IDE $189 / $209
ST-3390N SCSI $385
ST-3290A / 3390A IDE $225 / $285
ST-9145A / 3550A IDE $315 / $395
FREE DELIVERY:
ST-3655A / 3655N $539 / $569
ST-3550N SCSI $529
ST-11200N / 11950N $909 / $1,699
ST-42100N / 42400N SCSI $1,419 / $1,599
ST-12550N $1,959

Maxtor
IDE 7131A / 7245A / 7345A $189 / $245 / $299
IDE 7171A / 7213A / 7273A $209 / $225 / $335
IDE 7546A - Free Delivery $599
SCSI 7245 / 7345S $255 / $349
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CONNER The Storage Answer
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CFA170S / 340S SCSI $205 / $305
CP30254 IDE $265
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Quantum
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ELS 170 IDE / SCSI $189 / $195
LPS 270 IDE / SCSI $265 /$279
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Featuring CAVIAR
AC1210/AC2250 $199/$225
AC2340/AC2420 $265/$339
AC2540 $519

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adaptec
1522 SCSI Direction Kit 16 Bit Standard SCSI with Floppy Support & Drivers $135
1522 SCSI Direction PLUS Kit $189
1542CF Single $195
1542CF SCSI Master Kit / PLUS $249/$305
2742 Single NEW $295
2742T Kit NEW $349
2742T Single NEW $325
2842 VL Master Kit $299
Mini Scsi
T-130/T-160 $65/CALL
T-260/T-338 $155/$95
T-348/T-358 $169/$205
Slim SCSI, APA-460, PCMCIA, Free Del $289

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TMC-850 MCD CD ROM Kit $55
1680 SVP-ISA, 16 bit SCSI 2 with floppy support & CD ROM SCSI support $129
700 EXSVP-EISA $369

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Seagate ST-02 SCSI 8 Bit Adapt w/FD Cont $45
DTK PTI 227, 2 Serial 1 parallel, 1 game port, 1 floppy disk controller, 1 embedded hard disk drive adapter $29

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DJ20-250MB $165
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JT10(40-120) $269
JT20 (80-250) $315
POWERTAPE SYSTEM:
Includes Colorado Backup for DOS software 2GB Int / Ext, Free Delivery! $945 / $1,029

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5439A, 14", 39DP 1024x768, Inter $225
5468A, 14", 28DP 1024x768, Inter $255
1451Ni, 14", 28DP 1024x768, NI $269
1461, 14", 28DP 1024x768, NI $299
1560, 15", 28DP 1028x768 NI $395
1561, 15", 28 1024x768, NI $355
1760F, 17" Flat, 31DP, 1280x1024, NI $739

SONY
CPD 1320 UC2, 14", 640 x 480 VGA, $335
CPD 1430S, 14", 1024 x 768, NI, 8514A, 25 MM, cables & stand $585
CPD 1730S, 17",1024 x 768, NI, Free Del $1,039
CPD 17SEI 17", Free Delivery! $1,229

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5FGe, 17", 28, 1024x768, 76Hz $1,045
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4FGe EnergyStar Comp $669
5FGp Optical Surface $1329
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6FGp $2,249

MAG
MX15F/MX17F $515/$929

NANAO
F340IW / F550I $689 / $995
F550IW / F560IW $1189 / $1429

PACKARD BELL
PB8538 SVGA, 14", 39, 1024x768 $249
PB8549 SVGL, 14", 28, 1024x768, NI $339
PB8515 SVGL, 15", 28, 1024x768, NI $429
PB8517 SVGM, 17", 28, 1280x1024, NI $819

SCANNERS

Canon
IX 4015 Color Scanner, SCSI with Interface Includes Ofoto software $999

RELISYS
AVEC 3 Pass, Flatbed, Color Scanners
1200 PC/2400 PC/4800 PC $599/$799/$989
Reli Single Pass, Flatbed, Color Scanners
2400 PC / 9600 PC $1379 / $2779

LOGITECH
Scanman 256 (gray scale) $165
Scanman 256 with Omni Page Direct $209
Scanman Color with Omni Page Direct $429
FotoMan Plus $529
Scanman Easy Touch $215

EPSON
ActionScanning System PC CALL
ES-800C Bundle CALL
ES-800C Professional PC Bundle CALL

Mustek
ScanMagic 400 dpi Handheld 256 gs / Color Handheld $115 / $229
GrayArtist Handheld, 800 dpi $149
RnnScan 105, Handhald, 400 dpi $165
ColorArtist Pro Handheld 800 dpi $349
Paragon 600 Flatbed FREE DEL $839

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Smart 750 / 900 / 1250 $429 / $529 / $659
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BC 400 400 VA, 2 outlet $149
BC 500 500 VA, 4 outlet $179
BC 400LAN 400 VA, 4 outlet, LAN inter $149
BC 500LAN 500 VA, 4 outlet, LAN inter $189
BC 600LAN 600VA, 4 outlet, LAN inter $245
BC 750LAN 750 VA, 4 outlet, LAN inter $299
BC 900LAN 900 VA, 4 outlet, LAN inter $345
Omnipower Line Interactive UPS
OMNI 500LAN 450 VA $249
OMNI 600LAN 600 VA, $295

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Back Ups
250 / 400 $99 / $155
450 / 600 $185 / $255
900 / 1250 $365 / $489
Smart Ups
370 / 400 $309 / $285
600 / 900 $335/$535
1250 $689

NETWORKING

ARTISOFT
AE-2 Ethernet Adapter $179
Node Runner 2000C Adapter $159
Node Runner 2000C Starter DOS/Win $409/$465
Node Runner SI2000C Coax / 5 Pk $89/$429
Node Runner SI2000T Coax / 5 Pk $89/$429
Z Two Station Kit $81
Artisoft Central Station / II $319/$379
AI Dos/Win $77/$89
Simply LANtastic Intrenal Add-On Kit $97
Simply LANtastic Software Kit $189
Simply LANtastic Internal Starter Kit $189

3Com
Etherlink II 16 TP 8/16 Bit (503-16TP) $159
Etherlink II/16 8/16 (503-16) $149
Etherlink III Coax $119
Etherlink III TP $119
Etherlink II 8 bit TP $209
CALL FOR 5 PACK PRICING!

SMC
SMC Ethercard Ultra Elite 16C Combo $119
SMC Ethercard Ultra Elit 16T $99
SMC Ethercard Ultra Elite 16 $99
SMC Ethercard Plus Elite 16 $115
SMC Ethercard Plus Elite 16T $115
SMC Ethercard Plus Elite 16 Combo $135
CALL FOR 6 PACK PRICING!

National Semiconductor
Infomover NE2000 CTA-1 $109
Infomover NE2000 C-1 $99
Infomover NE2000 T-1 $89
Infomover NE4100 T-1 $199
Infomover NE4100 C-1 $199
CALL FOR 5 PACK PRICING!

NOVELL **National Semiconductor**
Personal Netware Single User1-0 $65
Personal Netware 5 User $259
Personal Netware Starter Kit Coax $239
Personal Netware Add-On $149

intel
Etherexpress 18 Bit Coax $99
Etherexpress 16 Bit Coax 10BT $99
Etherexpress 16 Bit Flash Coax $129
CALL FOR 5 PACK PRICING!

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DIAMOND
Speedstar Pro, 1MB / VLB $115 / $115
Stealth 1MG $199
Stealth 24, ISA / VLB $155 / $155
Stealth Pro, ISA, 1MB / 2MB $239 / $329
Stealth Pro, VLB 1MB / 2MB $245 / $329
Viper VLB 2MB / PCI 2MB $395 / $409

ATI
VGA Wonder GT Windows Accel $165
ATI Graphics plus 2MB $229
ATI Ultra Pro 2 MB / VLB $349 / $349
ATI Ultra Pro EISA 2MB $375

#9
9GXE, 1230 x 1024 NI, SVGA:
LVL 10, 1MB $239
LVL 11, 2MB $349
LVL 12, 3 MB $429
LVL 14, 4MB $629

Hercules
Dynamite VL Pro SVGA 1MG/2MG $159/$205
Graphite VL Pro HG SVGA 610/720 $249/$385

MICE

MICROSPEED
Microtrac PC 3 Button $65
Microtrac Mouse Deluxe $39
PC Trac Serial Trackball with Driver 3.0 $75
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Ethernet Adapters

Card type: 16 bit, ability to autoconfigure to 8 bit.

Network support: NetWare, LAN Manager, LAN Server, Windows for Workgroups, Windows NT.

Drivers: Eagle NE2000–compatible drivers, support for NDIS and ODI drivers.

Media connectors: For 10Base-5 (Thicknet), 10Base-2 (Thinnet), and 10Base-T (RJ-45); automatic sensing of media configuration.

Installation: Should be software configurable and support interrupt levels above IRQ 7.

Features and options: Upgradable boot PROM; SNMP support; polarity, collision, and link status LEDs; bus-mastering interface.

Other requirements: Diagnostic utilities, slot-bracket-mounted transmission and reception LEDs, 16K or larger buffer.

Windows Displays

Size: 17 inches; 20 to 21 inches for graphics applications.

Resolutions: 1,024 by 768; 1,280 by 1,024 for 20- or 21-inch monitors; noninterlaced.

Dot pitch: 0.28mm for 17-inch monitors; 0.31mm for 20-inch.

Vertical refresh rate: 72Hz or higher at all resolutions.

Tube type: Flat-square or Trinitron.

Controls: Front-panel digital image controls.

Features and options: Support for MPR II low-emissions standards, compliant with EPA Energy Star requirements.

Other requirements: Adjustable tilt-and-swivel base, video cable, antiglare coating or add-on filter.

Red flags: *Monitors with dot pitch above 0.31mm may seem fuzzy.*

Windows Accelerator Cards

Resolutions: 1,024 by 768; 1,280 by 1,024 for 20-inch monitors.

Colors: 256 colors at 1,024-by-768 resolution for business apps; 65,000 colors at 1,024 by 768 for near–photo-quality images.

Accelerator chip: Fixed-function chip such as S3 928, IIT AGX014, or ATI 68800 (Mach 32).

Vertical refresh rates: 72Hz at all resolutions.

RAM: 1MB for 256 colors at 1,024 by 768; 2MB or more for higher resolutions and more colors.

Features and options: VL-Bus or PCI model option, Windows utility to switch resolutions and colors.

Other requirements: Driver installation software, two-year warranty, Windows 3.1 drivers, free driver updates via BBS, CompuServe, or mail.

Red flags: *Interlaced boards and boards with 70Hz (or lower) vertical refresh rates produce more flicker.*

24-Bit Color Cards

Resolutions: 1,024 by 768 or higher.

Colors: 16.7 million colors at 1,024-by-768 or 1,152-by-870 resolution.

Graphics processor: For 24-bit Windows applications, a fixed-function processor; for 24-bit DOS apps, a full-fledged graphics coprocessor (T134020 chip).

Vertical refresh rates: 72Hz at all resolutions.

RAM: 4MB of VRAM (not DRAM).

Drivers: For Windows 3.1 and your specific DOS apps.

VGA support: Onboard VGA chip.

Features and options: VL-Bus, PCI, or EISA models, Windows utility to switch resolutions and colors.

Other requirements: 2-year warranty; free driver updates via CompuServe, BBS, or mail.

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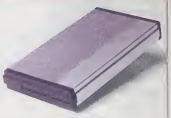


Transmission rate: 14,400 bps without compression, 57,600 bps with compression.

Supported standards: V.32bis (data speed), V.42 (error correction), V.42bis (data compression), CCITT Group 3 Class 1, Class 2, and CAS (fax).

Compatibility: Hayes.

Port selection: COM1 through COM4.

Bundled software: DOS and Windows communications and fax software, OCR software.

Features and options: Integrated voice, data, and fax; onboard digital-signal processor and coprocessor; 16550 universal asynchronous receiver/transmitter; LCD display on external modems; upgradability to V.Fast (V.34) protocol.

Red flags: *Fax modems without fallback transmission rates may not connect with other machines.*

Hard Drives

Performance: 13ms or faster average access time. If drive performance is reported as average seek time, look for 10ms or faster.

Capacity: 230MB or greater.

Size: Half height or full height, depending on your system's drive space.

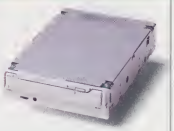
Interface: IDE for desktop systems with up to 1GB of capacity. For larger capacities, get a SCSI-2 drive interface.

Features and options: Self-parking heads, diagnostic and partitioning software.

Cache or buffer: 64K to 256K.

Red flags: *Mounting brackets and cables should come with the disk; look for a 30-day full money-back guarantee and a two- or three-year warranty.*

CD-ROM Drives



Access time: 200ms.

Transfer rate: Dual-speed drive: 150 Kbps to 300 Kbps.

Ondrive cache: 64K.

Interface: SCSI-2.

Compatibility: High Sierra (data) and ISO-9660, CD-Audio, and Photo CD (still photography) with multisession support (MPC 2).

Audio: Output jack and volume control.

Packaging: Internal.

Features and options: Bundled CD-ROM discs, single-handed operation.

Other requirements: Disk caddy (if needed).

Red flags: *Proprietary interfaces and drives that don't support MPC 2 will probably work with less software and hardware.*

Single-User Tape Drives

Storage capacity: 250MB when compressed.

Packaging: Internal 3½-inch drive preferred; external for PC-to-PC portability.

Interface: Floppy drive, IDE, or SCSI.

Cartridge type: DC6250 or equivalent, preformatted.

Bundled software: Windows and DOS backup software that supports either QIC-80 or QIC-525 tape format.

Other requirements: Floppy interface splitter or other interface cable, mounting hardware for internal drives.

Red flags: *Ensure full QIC-80 compatibility for QIC drives; avoid proprietary controller cards—they may take up an extra slot in your system; try for a price below $1 per megabyte.*

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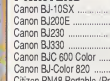
H.P. LaserJet 4M (with toner) 1919
Okidata 400 E LED 494
Okidata 410E LED 649
Okidata OL 810 LED 899



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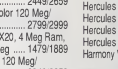

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Toshiba 1950 CS Color 120 Meg/ 200 Meg 2449/2659
Toshiba 1950 CT Color 120 Meg/ 200 Meg 2799/2999
Toshiba 1900 486SX20, 4 Meg Ram, 120 Meg/200 Meg 1479/1889
Toshiba 1900 Color 120 Meg/ 200 Meg 2049/2259
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Don't settle for less than these specs:

Network Laser Printers

Emulations: PCL 5, PostScript Level 2 with automatic emulation switching.

Print engine speed: At least 17 ppm.

Resolution: 600 dpi.

Processor: 16MHz RISC.

Resident fonts: 90 total; 10 TrueType (matching Windows 3.1), 45 PCL 5, 35 PostScript.

RAM: 8MB.

Interfaces: Parallel and 10Base-T or 10Base-2 Ethernet, token ring, or LocalTalk.

Network support: Concurrent support of Novell NetWare, Windows NT, Windows for Workgroups, LAN Manager, and LAN Server.

Paper capacity: 1,000 sheets.

Warranty: One year with onsite service.

Features and options: SNMP support.

Color Thermal Wax-Transfer Printers

Emulations: PostScript Level 2.

Print speed: 2 ppm.

Resolution: 300 dpi.

Processor: 16MHz RISC.

Printer language: PostScript Level 2.

RAM: 4MB.

Interface: Parallel.

Fonts: 35 Adobe Type 1.

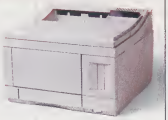
Ribbon: Three-color transfer ribbon.

Features and options: Internal network interfaces, support for 4-color (3 colors plus black) ribbons.

Other requirements: RAM expandable to 8MB, network interfaces.

Red flags: *Be sure vendor provides a PostScript Level 2 driver; despite some claims, business-quality printing on plain copier paper isn't a reality yet.*

Desktop Laser Printers



Emulations: PCL 5, PostScript option with automatic emulation switching and all ports active.

Print engine speed: 8 ppm.

Resolution: 600 dpi.

Resident fonts: 45 total; 10 TrueType fonts (matching Windows 3.1).

RAM: At least 2MB.

Interface: Bidirectional parallel.

Paper capacity: 200 sheets.

Footprint: 260 square inches or less.

Features and options: HP-compatible font cartridges, RISC processor for 600-dpi models, toner included.

Other requirements: Toner cartridge, parallel cable.

Red flags: *Proprietary cartridge slots may lock you in to one vendor.*

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Resolution: 400 to 600 dpi.

Image scanning capabilities: 24-bit color (16.7 million colors), grayscale (256 shades of gray), black and white.

Compatibility: TWAIN.

Interface: SCSI or SCSI-2.

Image controls: External controls for adjusting brightness, contrast, and color of scan; adjustable resolution.

Bundled software: 24-bit image-editing software, OCR software.

Features and options: Automatic document sheet feeder, transparency feeder.

Other requirements: Cables and SCSI adapter card included in price.

Red flags: *We recommend one-pass scanners for color documents, but if price is your top priority, don't rule out multiple-pass scanners.*

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486DX2/50	345MB	$1619
486DX2/66	345MB	$1789

*VGA color monitors begin at $229.99

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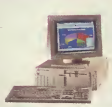

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T1950 486DX2/40	Dual scan color	200MB	$2719
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- 4MB RAM, expandable to 20MB
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- 2 PCMCIA slots
- Ballpoint mouse with QuickPort
- MS-DOS 6.0, Windows 3.1

Screen	Hard drive	Price
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Monochrome	200MB	$2297
Active color	120MB	$3889
Active color	200MB	$4099
Active color	320MB	$4449

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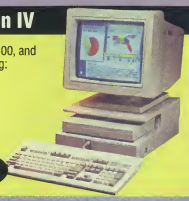

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Mono	209MB	$2199
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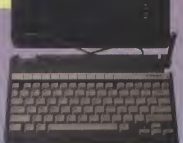

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486DX/33	240MB	$1469
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486DX/33	8MB	340MB	$3069
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DX2/40 Monochrome	250MB	$2989
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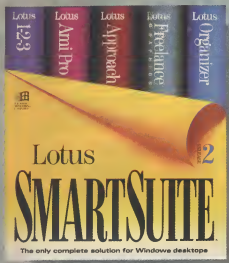

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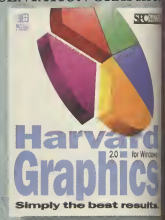

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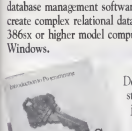

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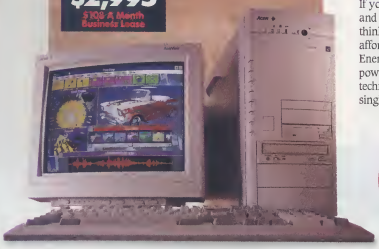

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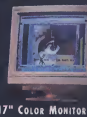

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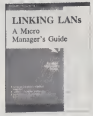

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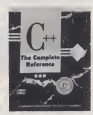

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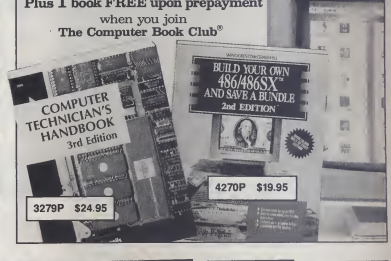

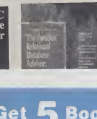

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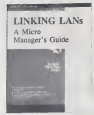

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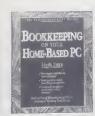

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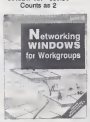

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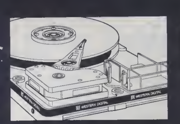

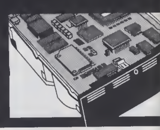

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SCS1			
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Syquest Media Best Price in this mag!

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expo 486DX2/66 MULTIMEDIA

- INTEL 66Mhz DX2 processor
- Desktop metal case, 128K cache
- Accelerated local bus
- 1 Mb Super VGA Video w/Windows Accelerator and displays 16.7 million colors
- 1.44 Mb floppy
- 102 key keyboard
- 15" Super VGA .28 non-interlaced monitor
- Multi I/O (2 serial, 1 parallel, 1 game port)
- MS-DOS 6.0, Windows 3.1, HI-Res mouse
- Remote diagnostic software
- 2400 baud modem with send-receive fax
- 8 Mb RAM, 424 Mb hard drive
- Double spin CD-ROM built-in
- Stereo sound board
- Plus 2 external speakers
- AD-lib compatible
- MPC compatible
- Sound blaster compatible
- Comptons encyclopedia CD-ROM included
- Websters dictionary
- World atlas

3 YEAR WARRANTY

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Every Expotech computer is equipped with a modem and special software that will let us access your computer, diagnose the hardware, solve the problem. *All from the comfort of your own telephone!*

3 YEAR WARRANTY

Standard Features

- Intel Pentium Technology ready
- Local Bus Graphics Accelerator with 1 MB RAM
- Desktop Metal Cases
- 5.25" and 3.5" floppy drives
- Remote Diagnostics Software
- 9600/2400 send/receive Fax/modem
- Anti-Virus Software
- Multi I/O - 2 Serial and 1 Parallel
- High performance keyboard, mouse
- MS-DOS 6.2, Windows 3.1

BEST BUY ▼

System 1	System 2	System 3	System 4	System 5
All Standard Features+	All Standard Features+	All Standard Features+	All Standard Features+	All Standard Features+
Intel 486SX25	Intel 486SX33	Intel 486DX33	Intel 486DX2/50	Intel 486DX2/66
210MB hard drive	210MB hard drive	340MB hard drive	424MB hard drive	424MB hard drive
4MB RAM	4MB RAM	4MB RAM	4MB RAM	8MB RAM
14" .28 non - interlaced monitor	14" .28 non - interlaced monitor	14" .28 non - interlaced monitor	14" .28 non - interlaced monitor	15" .28 non - interlaced monitor
		With 128k cache	With 128k cache	With 128k cache
$1149	$1199	$1499	$1599	$1899

Popular Options

■ 4, 8, or 16MB RAM ■ 15" .28 non-interlaced monitor ■ 17" .28 non-interlaced monitor ■ Combo floppy drives

SERVICE FEATURE	EXPO	DELL	GATEWAY	IBM	PACKARD BELL	AMIGO
3 YEAR WARRANTY	YES				YES	
REMOTE DIAGNOSTICS	YES				2700N	
24 HOUR TELETECH SUPPORT	YES			YES	YES	YES
FREE ON SITE SERVICE	YES	YES	YES		YES	YES
OPEN 7 DAYS / WEEK	YES	YES		YES		
EXPRESS PARTS SERVICE	YES	YES	YES	YES		
FAX TECHNICAL ADVICE	YES	YES	YES	YES		

SYSTEM FEATURE								
ANTI VIRUS SOFTWARE	YES							
FREE FAX/ MODEM	YES							
SERVICE VALUE RATING (PC COMPUTING JUN.-1993)	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★

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Choose VESA Performance

3 YEAR WARRANTY

Standard Features

- Intel Pentium Technology ready
- 2 VESA expansion slots
- VLB Graphics Accelerator with 1 MB RAM
- Desktop Metal Cases
- 3.5" floppy drive
- Remote Diagnostics Software
- 9600/2400 send/receive Fax/modem
- Anti-Virus Software
- Multi I/O - 2 Serial and 1 Parallel
- High performance-Tactile Keyboard, Mouse
- MS-DOS 6.2, Windows 3.1

Vesa Local Bus Systems

If you're after high speed Windows performance, the VESA local bus systems from Expotech deliver. By using the latest in VESA local bus technology these systems blow away the competition at prices that prove Expotech is the value leader.

By using the tremendous manufacturing resources of VTech, Expotech can deliver high quality products at the lowest possible cost. Expotech is the only choice when the bottom line is getting the most for your money..

Two VESA local bus slots are provided plus our high speed graphics accelerator make the VESA system from Expotech the highest value VLB system available.

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System 1	System 2	System 3	System 4	System 5
All Standard Features+	All Standard Features+	All Standard Features+	All Standard Features+	All Standard Features+
Intel 486SX33	Intel 486DX33	Intel 486DX2/50	Intel 486DX2/66	Intel 486DX2/66
250MB hard drive	340MB hard drive	424MB hard drive	424MB hard drive	424MB hard drive
4MB RAM	4MB RAM	4MB RAM	8MB RAM	16MB RAM
14" .28 non-interlaced monitor	14" .28 non-interlaced monitor	15" .28 non-interlaced monitor	15" .28 non-interlaced monitor	15" .28 non-interlaced monitor
	With 128k cache	With 128k cache	With 128k cache	With 128k cache
$1299	$1549	$1699	$1999	$2299

Popular Options

■ 4, 8, or 16MB RAM ■ 15" .28 non-interlaced monitor ■ 17" .28 non-interlaced monitor ■ Combo floppy drives

TOWER OPTIONAL

■ **24 hour tele-tech support.** Toll free tele-technical support available 24 hours a day.

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Standard Features

- Intel Pentium Technology ready
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- Desktop Metal Cases
- Remote Diagnostics
- 9600/2400 send/receive Fax/modem
- 3.5" floppy drive
- Double speed CD ROM
- Stereo speakers
- Stereo sound board
- High performance keyboard, mouse
- MS-DOS 6.2, Windows 3.1
- AD-lib, MPC compatible
- Sound blaster compatible
- Compton's Interactive Encyclopedia
- Webster's Dictionary
- World Atlas

BEST BUY ▼

System 1	System 2	System 3	System 4	System 5
All Standard Features+	All Standard Features+	All Standard Features+	All Standard Features+	All Standard Features+
Intel 486SX25	Intel 486SX33	Intel 486DX33	Intel 486DX2/50	Intel 486DX2/66
250MB hard drive	250MB hard drive	VLB accelerated graphics	VLB accelerated graphics	VLB accelerated graphics
4MB RAM	4MB RAM	340MB hard drive	424MB hard drive	424MB hard drive
14" .28 non-interfaced monitor	14" .28 non-interfaced monitor	4MB RAM	8MB RAM	8MB RAM
		15" .28 non-interfaced monitor	15" .28 non-interfaced monitor	15" .28 non-interfaced monitor
		With 128k cache	With 128k cache	With 128k cache
$1399	$1449	$1799	$1999	$2199

Popular Options ■ 4, 8, or 16MB RAM ■ 15" .28 non-interfaced monitor ■ 17" .28 non-interfaced monitor ■ Combo floppy drives

- **Bulletin board service.** Download drivers and talk to techs on line
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Multi-Media Systems

Multi-Media systems can really turn your computer into a complete information resource for you and your family. Stereo sound and full motion video, interactive encyclopedia, educational software and games really come to life.

VTech has been building complete multi-media systems for years and we know what it takes to get all system components working together. Your VTech system will arrive completely setup and ready to run.

The VTech multi-media systems all feature double speed CD-ROM drives that doubles the data throughout and really enhances video and audio performance of today's multi-media software.

The VTech sound board provides a full 20 voices rather than the usual 11 or 16 voices the other manufacturers provide.

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Technology you can afford

VTECH™ Platinum™

"Put the Power of Two Engines Under the Hood"
Computer Shopper, February, 1994

"The overall performance of the V-Tech gave it the highest ratings of any of the 486 systems, and the jaw dropping price is outstanding"
Computer Shopper, February, 1994

"Multiprocessing is clearly the wave of the future"
PC Week, August 23, 1993

"V-Tech leads in PC Multiprocessing"
PC Magazine, October 12, 1993

"The awesome V-Tech Platinum beats the Pentium and costs a cool $3,995"
Computer Shopper, February, 1994

"This system costs less than many single Pentium platforms, and its performance, at least under NT, would be 20 to 30 percent faster for any multithreaded application."
Computer Shopper, February, 1994

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Double your power

Advanced technology makes the difference.

VTech is the first and only company to bring Symmetrical Multiprocessing to the desktop at prices that compete with Single Processor Systems. The Vtech Platinum 486 computers are the fastest, most powerful systems available.

Upgradability

VTech provides you with three upgrade paths. From the single processor Platinum 486 you can upgrade to dual 486 processors, a single Pentium Overdrive™ processor, or for the ultimate in power and performance, dual Pentium Overdrive™ processors.

Each VTech Platinum 486 is designed with an exclusive copy back cache with cast-out buffering, high performance memory design, VESA Local Bus slots, two cooling fans, on board SCSI II, and self-sensing setup all managed by the industry's most advanced BIOS.

The VTech difference

Vtech engineers have developed a revolutionary system for achieving true Symmetrical Multiprocessors under Microsoft Windows NT. One year ago the experts told VTech it couldn't be done, but today the VTech Platinum SMP is receiving the critical acclaim that has earned the respect of the entire PC Industry.

VTech uses its own designs and makes almost every part of this system itself. "The finish work on the system is nice, with the inside of the case chrome-plated, and all the boardwork and connections clean and neat", stated *Computer Shopper.*

The VTech Platinum 486 is the only desktop computer that is Pentium OverDrive™ Ready and Symmetrical Multiprocessor ready. No more worrying about obsolescence, the VTech Platinum gives you the high performance you need today and the upgradability you'll need tomorrow.

SMP READY

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...Only from VTech

486DX2/50 single

- Intel 486DX2/50 Processor
- Pentium Overdrive™ ready
- SCSI II (on board)
- 256k Cache
- VESA Local Bus
- S3 Windows Accelerator Video Card w/1MB RAM
- 8MB System RAM
- 3.5" Floppy Drive
- 424MB Hard Drive
- 16550 Serial Port Controllers
- 15".28 Non-Interlaced Monitor
- MS DOS 6, Windows 3.1
- High Resolution Mouse

$1999

486DX2/66 single

- Intel 486DX2/66 Processor
- Pentium Overdrive™ ready
- SCSI II (on board)
- 256k Cache
- VESA Local Bus
- S3 Windows Accelerator Video Card w/1MB RAM
- 8MB System RAM
- 2X CD-ROM, 3.5 FD
- 424MB Hard Drive
- 16550 Serial Port Controllers
- 15".28 Non-Interlaced Monitor
- MS DOS 6, Windows 3.1
- High Resolution Mouse

$2299

486DX2/66 plus

- Intel 486DX2/66 Processor
- Pentium Overdrive™ ready
- SCSI II (on board)
- 256k Cache
- VESA Local Bus
- S3 Windows Accelerator Video Card w/1MB RAM
- 16MB System RAM
- 2X CD-ROM
- 3.5" Floppy Drive
- 424MB Hard Drive
- 16550 Serial Port Controllers
- 15".28 Non-Interlaced Monitor
- MS DOS 6, Windows 3.1
- High Resolution Mouse

$2799

486DX2/66 dual

- 2 Intel 486DX2/66 Processors
- Pentium Overdrive™ ready
- SCSI II (on board)
- 256k Cache
- VESA Local Bus
- S3 Windows Accelerator Video Card w/1MB RAM
- 16MB System RAM
- 2X CD-ROM
- 3.5" Floppy Drive
- 527MB Hard Drive
- 16550 Serial Port Controllers
- 15".28 Non-Interlaced Monitor
- MS DOS 6, Windows NT
- High Resolution Mouse

$3799

Options

15".28 Monitor ■ CD ROM Upgrades ■ Increased RAM ■ High Speed 14.4 Modems ■ Combo Floppy Drives ■ Multi-Media kit

Twice the Power, Performance & Expandability

Specifications

Processor
- Intel 486DX2/50 or 486DX2/66
- ZIF processor socket - Pentium Overdrive™ ready

Optional Multiprocessor
- MP Power Card with a second Intel 486DX2/50 or 486DX2/66 processor

Secondary Cache
- 256k Cache (Copy back w/cast out buffering)

Memory
- Supports 4, 8, 16 or 32MB SIMMS Four 72 pin SIMM sockets support 36 bit JDEC style SIMMs which may be inserted in any configuration

Bus Slots
- Six (6) ISA Slots
- Two (2) VESA VL Slots
- One (1) MP Connector Slot

Ports
- Two (2) serial ports 16550-DB9
- One (1) serial port ECP-DB25
- PS/2 mouse port
- IDE port-floppy controller
- SCSI II connector on board

Chassis
- Height 6.5" Width 16.6" Depth 17.1"
- Supports three 5.25" or 3.5" external drive bays and one 3.5" internal hard disk drive

The Expandable 486

Advanced BIOS
- Supports multiprocessing start-up for advanced SMP capable operating system (Windows NT)
- Automatically detects and reports all processors installed and active
- Flexible memory configuration supports 288MB floppy drives
- Ability to autotype IDE hard disk
- Built-in Adaptec SCSI II support
- Two level password protection

VTECH™ Platinum

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- **Bulletin Board Service**
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- **One Year On-Site Warranty**
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Introducing Pentium. The newest addition to the Platinum series

Standard Features

- Intel 60MHz Pentium processor
- Next generation Pentium Overdrive processor P5T ready
- 256k cache
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- Window's accelerator with 1MB expandable to 2MB
- Dual cooling fans
- Advance BIOS with 2.88MB floppy drive support
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- Enhanced capabilities port
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- 15" non-interlaced monitor
- Self sensing set-up
- High performance-tactile keyboard
- MS-DOS 6.2, Windows 3.1

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Platinum P5-60

- **All Standard Features+**
- 424MB hard drive
- 8MB RAM
- Double speed CD-ROM

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Platinum P5-60

- **All Standard Features+**
- 527MB hard drive
- 16MB RAM
- Double speed CD-ROM
- 15" non-interlaced monitor

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Popular Options

- 4MB, 8MB, 16MB or 32MB RAM
- 17" non-interlaced monitor
- Combo floppy drives

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CACHE MEMORY

	12NS	15NS	20NS	25NS
8Kx8	–	6 50	6 00	5 50
32Kx8	28.00	9 00	8 00	7 00
64Kx1	–	11 00	9 00	6.00
64Kx4	–	11 00	9 00	8.00
16Kx4	–	8 00	7 00	6.00
128Kx8	–	–	49 00	36.00

Individual D-RAM Chips

MEMORY FOR IBM & APPLE

	80NS	70NS	60NS	100NS
1Megx1	7 35	7 25	6 75	4.95
1Megx4	35 00	29 00	27 00	–
1Megx4 (Zip Pack)	27 00	25 00	23 00	–
256 x 4 (Video Zip)	–	–	11 95	10 95
256x4	7 95	8 95	–	–
256 x1	3.00	2 75	2 50	2 25
256 x18VRAM	–	39 00	39 00	–
64x4	–	–	3 25	–
64x1	–	–	–	2 00

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8087	45 00
8087-2	49 00
8087-1	65 00
80287-XL	55 00
80387-16 DX	45 00
80387-20 DX	55 00
80387-DX (Does All)	79 00
80487-SX (Does All)	309 00
Intel SX (Does All)	79 00
Intel SL Mobil	85 00
Intel 16SX	49 00
Intel 20SX	54 00

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Ambra Pentium-60	4/8/16 Meg	CALL
Ambra S4540SL	4/16 Meg Kit	CALL
Ambra Sprinta 386, Hurdla 386SX, Enterprise 386 Slim	2/6 Meg Kit	CALL
Ambra Sprinta Hurdla & Enterprise 486	4/16 Meg Kit	CALL
Ambra NC 425SL	2/4/8 Meg	109 00/209 00/449 00
Ambra N Series	4/8/12/16 Meg	189 00/379 00/569 00/829 00
Ambra SN Series	4/16 Meg	189 00/829 00

CYRIX DRx² 386 to 486 Upgrade
Clock Doubler

- Single chip upgrade solution
- Clock doubling technology
- Compatible with industry standard 386DX CPU socket
- Compatible with DOS, Windows, 3.X, OS/2 1.3 and 2.a
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The Cyrix upgrade runs at twice the speed of your original 386 microprocessor combined with a 1K on-chip cache you will enjoy a performance boost of 100% and more Ideal for any DOS, Windows or OS/2 application which requires a large amount of microprocessor horsepower

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CX486 DRx²-33/66	CALL
CX486 SRX2 16/32	249.00
CX486 SRX2 20/40	249.00
CX486 SRX2 25/50	279.00

SIMM MODULES (Add $5.00 for SIPP)

	40NS	50NS	60NS	70NS	80NS	100NS
1Meg x 9 (3 chip)	55 00	55 00	42.00	41 00	40.00	–
1Meg x 9 (9 chip)	60 00	58 00	49.00	48.00	46 00	38 00
4Meg x 9	–	–	165.00	159 00	149 00	–
16Meg x 9 (9 chip)	–	–	–	799 00	–	–
16Meg x 9 (36 chip)	–	–	–	–	–	–

72 PIN SIMMS (EISA)

256 x 36 1Meg	–	–	–	–	59 00	–
512 x 36 2Meg	–	–	–	89 00	84 00	–
1 x 36 4Meg	–	–	190 00	180 00	175 00	–
2 x 36 8Meg (w/pel)	–	–	359 00	389 00	409 00	–
2 x 36 8Meg (w/o pel)		–	359 00	449 00	449 00	–
4 x 36 16Meg		–	689 00	649 00	649 00	–
8 x 36 32Meg	–	–	1549 00	1499 00	–	–
16 x 36 64Meg	–	–	CALL	3516 00	–	–

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MODEL	AMT UPGRADED	AST PART #	PRICE
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	4Meg	500987-002	179 00
	8Meg	500987-003	419 00
	16Meg	500987-004	619 00
	32Meg	500987-005	1399 00
Premium 486/25, 25E 33, 33E			
Premium 386/33TE 486/25TE, 33TE			
Prem Serv., Prem II 386SX/20, 25			
Prem II 386/25, 386/33 486/33 486SX/20	8Meg	500780-001	398 00
Premium 326/33T Prem 386SX/16			
Prem II 386SX/20, 25		500780-004	189 00
Premium 386/25, 33, 386/33T, 386SX/16		500780-003	59 00
Prem II 386SX20 25		500760-001	59 00
Premia	8Meg	501159-002	379 00
Premia	16Meg	501159-003	769 00
Premia	32Meg	501159 004	1469 00
Premia	64Meg	501159-005	3111 00

ZENITH MEMORY MODULES

MODEL	AMT. UPGRADED	ABT PART #	PRICE
Z386/33, 25, 20, 33E	1Meg	ZA3800ME	59 00
Z386/33, 25, 20, 33E, 486/25E	4Meg	ZA3800MK	180.00
Z386SX	2Meg	Z-605-1 modules	119.00

MAGNAVOX

286/386SX-16, 386SX-20, 486SX-20 & 386-33 *all are 72PIN SIMM*

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0-32Meg, Ext-Expnd Memory Bd for P/S2 70, 80, 90, Lim 4 0

0Meg	2Meg	4Meg	8Meg	16Meg	32Meg	64Meg
$139.99	$238.99	$319.09	$499.99	$850.90	$1599.99	CALL

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IBM PS/1, PS/2 MEMORY MODULES

IBM PART NO.	WORKS WITH MODEL NO	PRICE
30F5348 (512K)	30-286	37 00
30F5360 (2Meg)	30-286, 25-286, 50 MTHR BD	104 00
6450375 (1Meg)	80-041	79.00
6450379 (2Meg)	80-111, 311-121 321, 081, 161	84 00
6451060 (4Meg)	80-A21, A-61 80-A31, 80-111, 80-311	189 00
6450604 (2Meg)	70 061, E61, 121, 50Z, 55SX, 65SX, P-70, 55LS, 65LS, X-Station 120 & 130, 35SX, 35LS, 40SX	89.00
6450608 (2Meg)	70-A21, A-61, B-21, B-61, 35SX, 35LS, 40SX, Val Pt. 325T	90 00
78X8955 (128K)	25	35 00
34F2933 (4Meg)	35SX, 40SX, 55SX, 65SX, 55LS, 65LS	180 00
87F9977 (4Meg)	55SX 55LS, 65SX, 40SX, 35SX, 35LS	180 00
1057035 (512K)	P/S1-286	49.00
92F9935 (2Meg)	P/S1 & P/S1/386SX-2121	98.00
92F9694 (4Meg)	P/S1 & P/S1/386SX Model-2121	169 00
6450902 (2Meg)	56, 57, 57SX, 90, 95, P-75, 57SLC Value Point 77 486DX2, 486SX, SVR 85	90 00
6450128 (4Meg)	57SX, 90, 95, P-75, 57SLC, 56, 56SLC, P/S1, 386SX Mod-2123, 2133, 2155, Val Pt 77, 486CS2, 486SX, SVR85 Value Point 77 486DX2, 486SX, SVR 85	175 00
6450129 (8Meg)	35SX, 40SX	379 00
6450130 (8Meg)	58, 57, 57SX 90, 95, P-75, 57SLC Value Point 77 486DX2, 486SX, SVR 85	379 00
4010 (16 Meg kit)	RISC System/6000	769 00
4033 (32 Meg kit)	RISC System/6000	1699 00
4036 (64 Meg kit)	RISC System/6000	3319 00

IBM NOTEBOOK & LAPTOP MEMORY

79F0999 (2Meg)	LX40, N33SX, PS Note	103 00
79F1000 (4Meg)	LX40, N33SX, PS Note, Thinkpad 350 350c	199 00
79F1001 (8Meg)	LX40, N33SX, PS Note	349 00
07G1826 (2Meg)	N51 (all)	103 00
07G1827 (4Meg)	N51 (all)	199 00
07G1828 (8Meg)	N51 (all)	419 00
53G6958 (2Meg)	Thinkpad 710T	CALL
53G6959 (4Meg)	Thinkpad 710T	CALL
53G6960 (8Meg)	Thinkpad 710T	CALL
07G1414 (2Meg)	Thinkpad 750, 750c	119 00
07G1415 (4Meg)	Thinkpad 750, 750c	214 00
07G1416 (8Meg)	Thinkpad 750 750c	419 00
66G0094 (16Meg)	Thinkpad 750, 750c	959 00
07G1420 (4Meg)	CL57LSX LpTp, Thinkpad 700, 700C, 720, 720C	214 00
07G1421 (8Meg)	CL57LSX LpTp, Thinkpad 700, 700C, 720, 720C	419 00
60G0378 (8Meg)	Thinkpad 350, 350c	359 00
60G0379 (16Meg)	Thinkpad 360, 350c	679 00
92F8804 (2Meg)	N45SL	109 00

COMPAQ MEMORY MODULES

MODEL	AMT. UPGRADED	CMPQ PART #	PRICE
DeskPro 386/33 386/33L, 486/25, 486/33L, 486/50L, System Pro	2Meg Module	115144-001	109 00
	8Meg Module	116561-001	429 00
	32Meg Module	116566-001	1459 00
DeskPro 386/33L, 486/33L	(Exp Bd)	116589-001	279 00
DeskPro 386/25, 386/20	1Meg Module	113131-001	79 00
	4Meg Module	113132-001	219 00
DeskPro 386S-16MHz	1Meg Exp Bd	113633-001	149 00
	4Meg Exp Bd	113634-001	329 00
	1Meg Module	113646-001	79 00
	4Meg Module	112534-001	219 00
DeskPro 386/20E	1Meg Exp Bd	113644-001	149 00
DeskPro 386/25E	4Meg Exp Bd	113645-001	329 00
	1Meg Module	113131-001	79 00
	4Meg Module	113132-001	219 00
DeskPro 286N 386N, 386SX/20, 386/25M 486/33M, 486S/25M, 486S/16M	1Meg Module	116688-001	59 00
	2Meg Module	118689-001	89 00
	4Meg Module	116690-001	180 00
Port I Series 486C	8Meg Module	128877-001	389 00
M Series Exp Bd	0-64Meg	129160-001	279 00
DeskPro 386/16	1Meg Kit	108071-001	99 00
	4Meg Kit	108072-001	299 00
	1-2Meg Exp Bd	108069-001	239 00
	4-8Meg Exp Bd	108070-001	437 00
DeskPro 286	512K Kit	113012-001	49 00
DeskPro 5/60, 5/66M, 5/66M (ALL OF THESE MACHINES USE THESE MODULES)	8Meg Kit	149911-001	389 00
Prosignia 5/60	16Meg Kit	149949-001	739 00
Proliant 100 5/60	32Meg Kit	149912-001	1599 00
Proliant 2000 4/30, 5/66	64Meg Kit	149913-001	2700 00
Proliant 4000 4/50, 5/66	128Meg Kit	149914-001	6900 00
Prolinea 386 3/25S, 3/252S	2Meg	141738-001	109 00
	8Meg	141742-001	320 00
Prolinea 486 4/25S, 4/33, 4/50, 4/66, CDS	2Meg	141683-001	95 00
	4Meg	141684-001	180 00
	8Meg	141685-001	399 00
Prosignia PC Server, 486/33, 486 DSX/66	8Meg	141885-001	399 00
	16Meg	149320-001	719 00
	32Meg	149147-001	1825 00

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LTE/286	2Meg Bd	117081-002	99 00
LTE/286	4Meg Bd	117081-003	179 00
LTE/386S/20	4Meg Module	121125-002	229 00
LTE LITE/20, 25, 25C	4Meg Module	129769-002	229 00
LTE LITE/20, 25, 25C	8Meg Module	128769-003	389 00
LTE LITE/20, 25, 25C	16Meg Module	129789-004	809 00
LTE LITE 4/25C, 4/23E, 433C	4Meg Module	142337-002	199 00
LTE LITE 4/25C, 4/23E, 433C	8Meg Module	142337-003	384 00
LTE LITE 4/25C, 4/23E, 433C	16Meg Module	142337-004	789 00
SLT/286	1Meg Module	110235-001	75 00
SLT/286	4Meg Module	110237-001	249 00
SLT/386	1Meg Module	118303-001	79 00
SLT/386	2Meg Module	118304-001	109 00
SLT/386	4Meg Module	118305-001	219 00
Concerto	4Meg	144790-001	CALL
	8Meg	144790-002	CALL
	16Meg	144790-003	CALL
Contura 320, 325	2Meg	139497-001	104 00
	4Meg	139498-001	189 00
	8Meg	139499-001	349 00
Contura 4/25, 4/25C, 4/25CX	4Meg	146520-001	189 00
	8Meg	146521-001	349 00
	16Meg	146531-001	799 00

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MODEL	PRICE	MODEL	PRICE
S-RAM Cards 1MEG	159.00	14,400/14,400 Data/Fax Modems	319 00
S-RAM Cards 2MEG	178.00	9600/9600 Data/Fax Modems	259 00
Card Pro (made by Data I/O) Transfers data from PCMCIA card to desktop PC, connects to a parallel port	299 00	2400/9600 Data/Fax Modems	179 00
		Lan Ethernet (10 Base T)	219 00
		Visual Media (CD Rom, Tape Dr)	278 00

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T2000/T2000SX	2Meg	PC18-PA8317U	94 00
T2000SX/T1000LE	4Meg	PC-PA8314U	209 00
T2000SX/T1000LE	8Meg	PC14-PA8315U	399 00
T2000SXE/2200SX/T1800, 1850, C	2Meg	PC-PA2000U	94 00
T2000SXE/2200SX/T1800, 1850, C	4Meg	PC-PA2001U	209 00
T2000SXE/2200SX/T1800, 1850, C	8Meg	PC-PA2002U	389 00
T4400SX, SXC T6400	4Meg	PC-PA2004U	209 00
T4400SX, SXC T6400	8Meg	PC-PA2005U	399 00
T4400SX, SXC T6400	16Meg	PC-PA2010U	704 00
T4500, T4500C, T4600, T1900 T1900C (3 3 v)	4Meg	PC-PA2012U	219 00
T4500, T4500C, T4600, T1900 T1900C (3 3 v)	8Meg	PC-PA2013U	439 00
T4500, T4500C, T4800, T1900, T1900C (3 3 v)	16Meg	PC-PA2014U	959 00
T3300SL	6Meg	PC-PA2008U	329 00
T3300SL	16Meg	PC-PA2009U	699 00
T1200XE	2Meg	PC13-PA8306	99 00
T1600	2Meg	PC8-PA8302U	99 00
T3100	2Meg	PC3-PA7135E	179 00
T3100e	2Meg	PC9-PA834DU	109 00
T3100SX	2Meg	PC15-PA8308U	109 00
T3100SX	4Meg	PC15-PA8310U	209 00
T3200	3Meg	PC6-PA7137U	185 00
T3200SX	2Meg	PC12-PA8307U	119 00
T3200SX	4Meg	PC12-PA8909	209 00
T3200SXC	2Meg	PC19-PA8318U	119 00
T3200SXC	4Meg	PC19-PA8319U	219 00
T6100	2Meg	PC7-PA8301U	95 00
T5200/T8500	2Meg	PC10-PA8304U	114 00
T5200/T8500	8Meg	PC10-PA8313U	419 00

NOTEBOOK, LAPTOP MEMORY

MODEL	AMT UPGRADED	MANU PART #	PRICE
ACER 730	2Meg/4Meg/8Meg		109/209/449
ACER 750	4Meg/8Meg/16Meg		199/459/869
ALR Venture	4Meg	12407980	249 00
AST Bravo & Explorer	4Meg 16Meg	501255-001, -002	199 00/829 00
AST Notebook Prem Exec 386SX/20/25/25L	4Meg	500814-003	199 00
AST Power Exec 3/25C, 425EL	4Meg		199 00
AST Power Exec 3/25C, 425EL	16Meg		819 00
AST Power Exec 425SL	4Meg	501166-001	199 00
AST Power Exec 425SL	16Meg	501166 003	819 00
AT&T Safari NSX/20	4Meg	PEC 37651	259 00
Bondwell 6310 Plus	1Meg	23050-09100	109 00
Bondwell 6310V SX	1Meg		109 00
Bondwell 8310V SX	4Meg		229 00
Epson NB3	4Meg	A808511	199 00
Everex Tempo LX LX20 Carrier	2Meg	PCA 00053-0001	99 00
Gateway 2000 Nomad 425 DXL/SXL	4Meg/16Meg		199 00/1549 00
Goldstar GS520 386SX/16	4Meg	S386-4M	240 00
Magnavox Metalis	1Meg 4Meg	286, 386SX	109 00 199 00
NEC Prospeed 286, 386SX-16	1Meg	PC21 21	79 00
NEC Prospeed 286 386SX-16	4Meg	PC21-22	199 00
NEC Prospeed 386	2Meg	PC31-21	119 00
NEC Prospeed 386	8Meg	PC31-22	399 00
NEC Prospeed 386SX-20	1Meg	PC43-21	79 00
NEC Prospeed 386SX-20	4Meg	PC43 22	109 00
NEC Ultralite III/20 20P 25C	2Meg	PC47 21	109 00
NEC Ultralite III/SL/25C	4Meg	PC47-22	199 00
NEC Ultralite SL/20, 20P	6Meg	PC49-21	309 00
NEC Ultralite III/25C	8Meg	PC47-23	389 00
NEC Ultralite Versa	4 Meg/8Meg/16Meg/20Meg	OP4104	209 429, 849, 104
Packard Bell 386SX 286	1Meg 4Meg	286 386SX	109 199
Panasonic CF170 CF270 CF370	1Meg	CF-BA165	49 00
Panasonic CF380	2meg/4Meg/6Meg		CALL/CALL/CALL
Panasonic CF480	2Meg/6Meg		CALL/CALL
Sanyo 17/18 NB	2Meg	MBC-NBMEM2	99 00
Sharp 6781, 6881, 6785	2Meg/4Meg		109 00/199 00
Sharp PC-6220	1Meg	CE 6218	70 00
Tandon, PC Brand, Dataworld	2Meg 8Meg	NB386SX-20	119 00 429 00
TI Travelmate 2000	1Meg	2568034-0001	70 00
TI Travelmate 3000	2Meg	2566996-1	84 00
TI 4000	4Meg, 16Meg		199 00, 1540 00
Twinhead Altima Compudyne Tandy 4860 486SX DX	4Meg/16Meg		199 00/859 00
Zeos 386SX Notebook	2Meg		99 00
Zenith Master Sport 386SX	2Meg	ZA-300-1	114 00
Zenith Master Sport SL, SLE	2Meg	ZA-4-4	119 00
Zenith Super Sport 286 286E	1Meg	ZA-180-86	99 00
286E SX	2Meg	ZA-180-64	179 00
SX Alpha	2Meg	ZA-180-86	179 00
SX Beta	2Meg	ZA-180-87	179 00
Zenith Z-Note 325L, LC	2Meg/8Meg	ZA3250-4/5	129 00/419 00
Zenith Z-Note 425LN, LNC LNP	4/8/16Meg		269/519/839

LASER PRINTER MEMORY UPGRADES

AMOUNT UPGRADED	0K Bd	256k	1	2	3	3.5	4	5	6	8	16	32
Canon LBP4, 4Lite 4plus	–	–	158	210	–	–	–	–	–	–	–	–
Compaq Pagemarq	–	–	–	88	–	–	180	–	–	369	–	–
Epson 6000, Action Laser	–	–	–	139	–	–	229	–	–	–	–	–
Epson Action Laser II	–	–	89	–	Call	–	–	Call	–	–	–	–
Epson 8000	–	–	89	–	Call	–	–	Call	–	–	–	–
Epson 1000, 1500	–	–	–	Call	–	–	Call	–	Call	–	–	–
HP 2, 2D–	–	–	–	109	–	–	189	–	–	–	–	–
HP 3 3D, 3P, 2P 2P+	–	–	–	101	–	–	179	–	–	–	–	–
HP 4, 4M, 4SI, 4SIMX	–	–	–	88	–	–	180	–	–	364	–	–
HP 4L	–	–	59	–	–	–	–	–	–	–	–	–
HP 3SI	–	–	89	–	–	–	180	–	–	359	–	–
HP 4SI	–	–	–	68	–	–	180	–	–	358	–	–
HP Design Jet 600 650	–	–	–	–	–	–	180	–	–	359	–	–
HP Deskjet 500, 500C 550	–	59	–	–	–	–	–	–	–	–	–	–
HP Deskjet 1200C, 1200C/P	–	–	–	89	–	–	180	–	–	359	–	–
HP Paintjet XL300	109	–	–	–	–	–	289	–	–	469	837	–
IBM Laser 4019, 4019E	–	–	–	–	–	159	–	–	–	–	–	–
IBM Laser 4029	–	–	–	–	–	–	180	–	–	–	–	–
IBM Laser 4039, 4079	–	–	–	99	–	–	180	–	–	350	–	–
NEC 90, 290	–	–	–	139	–	–	–	–	–	–	–	–
NEC 95, 97	–	–	–	98	–	–	–	–	–	–	–	–
Oki 400	–	–	–	89	–	–	–	–	–	–	–	–
Oki 400 E	–	–	135	189	–	–	–	–	–	–	–	–
Oki 830 640	–	–	–	109	–	–	–	–	–	–	–	–
Packard Bell PB 8500	–	–	–	139	–	–	227	–	–	–	–	–
Packard Bell 9815	–	–	–	180	–	–	299	–	–	–	–	–
Panasonic 4420/4450I	–	–	–	128	–	–	209	–	–	–	–	–
Panasonic 4410/4430	–	–	–	126	–	–	195	–	–	–	–	–
Panasonic 4450	–	–	99	–	–	–	–	–	–	–	–	–
TI XL/PS17/PS35	–	–	55	–	–	–	–	–	–	–	–	–

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- PCI Local Bus Graphics Card
- 1 Parallel and 2 Serial Ports
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- Intel PCI Local Bus Graphics Card
- Internal 14.4 S/R Fax Modem
- 1 Parallel and 2 Serial Ports
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
- 8-Bay Middle Tower Case
- *FREE* Microsoft DOS 6.2 *Installed*
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486DX2-66 $1999

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Built to last, Elite VESA Systems avoid bottlenecks by giving video cards first priority in using the processor. With a 32-bit link between the system processor and the video card, Elite Systems move video information at the speed of the processor (up to 66 MHz). That's an earth-shattering improvement over the 8 MHz bus speeds of ISA and EISA systems. For optimized video performance, choose the best—an Elite VESA Local Bus System.

Treasures:

- Intel 486DX2-66 Processor
- 128K High-Speed Cache
- 8 Mb High-Speed RAM
- 340 Mb IDE Hard Drive
- 1.44 Mb 3.5" Floppy Drive
- Dual Speed Multimedia CD-ROM Drive
- 15" SVGA .28 Non-Interlaced Multi-Scan Color Monitor with Hitachi CRT
- 32-Bit VESA Local Bus SVGA Video Card
- 32-Bit VESA Local Bus IDE Card
- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
- 8-Bay Mini-Tower Case
- FREE Microsoft DOS 6.2 *Installed*
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Elite 486SX/DX Notebook

SL-Enhanced Processor
Up to 520 Mb HDD
PCMCIA Type III

intel inside

A Dream Come True

Almost every ancient Egyptian dreamed of having a portable computer. Thanks to the 486SX/DX Notebooks, their dreams can come true for you.

These Elite Notebooks feature Intel's "SL-Enhanced" microprocessors, delivering excellent power management and a long battery life. The centerpiece of SL Technology is the System Management Mode (SMM), which allows your Notebook to slow down, suspend or completely shut down various components of your system.

The 486SX/DX Notebooks come with a divine gift—the gift of choice.

Depending on your specific needs, choose from a 120, 200, 340 or 520 Mb hard drive, an upgradeable 486SX-25, DX-33, DX2-50 or DX2-66 processor. Also choose from a large 10" monochrome screen, active-matrix color screen, or the new 10.3" dual-scan color screen.

Elite's 486SX/DX Notebooks also feature the latest PCMCIA technology. They all have a PCMCIA Type III slot, which accepts two Type I cards, two Type II cards or one Type III card. Use these cards to add memory enhancements, network adapters, modems and more.

Buy the notebook ancient Egyptians only dreamed of—order your Elite 486SX/DX Notebook today.

	Monochrome		Dual-Scan Color		Active Matrix Color	
CPU	SX-25	DX-33	SX-25	DX2-66	DX2-50	DX2-66
Hard Drive	120 Mb	200 Mb	200 Mb	340 Mb	340 Mb	520 Mb
Price	#005501 **$1399**	#005517 **$1599**	#005579 **$1999**	#005580 **$2499**	#005581 **$3499**	#005582 **$3999**

Dual-Scan Color Notebooks include Windows.
Active Matrix Color Notebooks include Windows and an additional 4 Mb of RAM for a total of 8 Mb.

Treasures:

Processor:
Intel 486SX-25, 486DX-33, 486DX2-50 or 486DX2-66
SL-Enhanced upgradeable processor

RAM:
4 Mb, expands to 20 Mb

Hard Drive:
120 Mb, 200 Mb, 340 Mb or 520 Mb

Screen:
10" on Mono or Active units
10.3" on Dual Scan units
Backlit display
Color - 256 colors
Monochrome - 64 gray shades

Battery Life*:
Active Color - 3 hours
Dual-Scan Color - 4 hours
Monochrome - 6 hours

Weight:
Color - 6.9 lbs.
Monochrome - 6.4 lbs.

512K DRAM with turbo bus accelerated video technology

Simultaneous video on active-matrix color and monochrome units

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Built-in trackball

Built-in 1.44 Mb, 3.5" floppy drive
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Elite 486SX-25 SubNote

Ancient Egypt is known for great myths, historical treasures and powerful dynasties. You can discover another source of great power with Elite's 486SX-25 SubNote.

The 486SX-25 has the latest features, like Intel's "SL-Enhanced" processor, Advanced Power Management and PCMCIA technology.

It's a mystery how a little 3.9 lb. SubNote contains as much power as a desktop, but it does. The 486SX-25 comes with 4 Mb of RAM, expandable to 12 Mb, a fast 25 MHz processing speed and your choice of a 120, 200 or 340 Mb hard drive. It also delivers excellent 640 x 480 VGA resolution on its 10" high-contrast screen producing clear, concise images that even a mummy can easily see!

Elite's unforgettable SubNote symbolizes power, ground-breaking technology and true portability. Before you hop on your camel to start your next historical journey—call MidWest Micro and order the 486SX-25.

Treasures:

Processor:
Intel 486SX SL-Enhanced processor

Processing Speed:
25 MHz

RAM:
4 Mb expands, to 12 Mb

Hard Drive:
120 Mb, 200 Mb or 340 Mb

Screen:
10", 640 x 480 VGA resolution
Backlit display
64 gray shades

Battery Life*:
5 hours

Weight:
3.9 lbs.

512K DRAM with turbo bus accelerated video technology
Simultaneous video
83 keys with 101-key emulation
Built-in trackball
External 1.44 Mb, 3.5" floppy drive
Advanced Power Management
Nickel metal hydride battery
One parallel and one serial port
External VGA and keyboard connectors
One PCMCIA Type II slot
FREE AC adapter and utilities disk
FREE MS-DOS 6.2 installed
FREE carrying case

486SX-25 SubNote		
120 Mb	#005576	$1399
200 Mb	#005577	$1479
340 Mb	#005578	$1579

Elite 486SLC2-50 Color/Monochrome Notebook

Discover the riches of the land with your Elite 486SLC2-50 Notebook. This portable is perfect for long journeys due to its compact size and energy-saving SUSPEND/ RESUME feature. You can even compute up to six hours on a single charge!

Available in color or monochrome, the Elite comes with a fast 50 MHz processor, internal cache memory and up to 8 Mb of RAM—giving you more power for your money!

Both 486SLC2-50 models have a record of unparalleled success in eliminating distortion and eyestrain with their non-glare VGA screens. Images appear at up to 640 x 480 resolutions in 64 gray shades or 256 colors revealing eye-catching text, graphics and hieroglyphics.

Your Elite's LCD panel lets you know which drives are being accessed, when battery power is low, what function keys are enabled, whether external power is being used and if there is a modem ring. All the information you desire is right before your eyes!

The wait is over for both you and the Pharaohs. Your Elite Notebook is here—and it's just a toll-free phone call away.

Treasures:

Processor:
Cyrix 486SLC2-50

Processing Speed:
50 MHz

RAM:
2 Mb RAM, expands to 8 Mb

Hard Drive:
120 Mb or 200 Mb

Floppy Drive:
Built-in 1.44 Mb 3.5"

Screen:
Color - 9", 256 colors
Monochrome - 10", 64 gray shades

Video RAM:
512K

Keyboard:
83 key with 101-key emulation
2-button thumball mouse

Weight:
Color - 5.7 lbs. with battery
Monochrome - 5.4 lbs. with battery

Battery Life*:
Color - 4 hours
Monochrome - 6 hours

640 x 480 resolution
Simultaneous video
Local Bus Video
Advanced Power Management
One parallel and one serial interface
External VGA monitor and keyboard connectors
FREE AC adapter, carrying case and MS-DOS 6.2 installed
One year manufacturer's warranty

	120 Mb		200 Mb	
Color	#005476	$1639	#005477	$1699
Monochrome	#005482	$1259	#005483	$1329

*Battery life measured with Power Management enabled. Actual battery life may vary.

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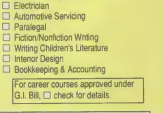

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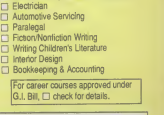

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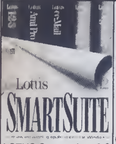

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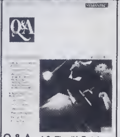

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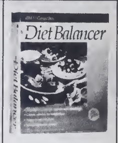

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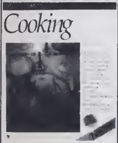

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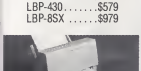

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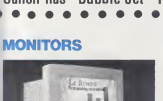

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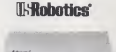

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KX-P2124 Dot Matrix	315
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250MB	IDE	WD225ØA	12ms	3 5" 1"H	219	239
340MB	IDE	WD234OA	12ms	3 5" 1"H	279	299
420MB	IDE	WD242ØA	12ms	3.5" 1"H	369	389
540MB	IDE	WD254ØA	12ms	3.5" 1"H	499	519
CONNER						
170MB	IDE	CP3Ø17A	17ms	3.5" 1"H	$189	$209
250MB	IDE	CP3O254	16ms	3.5" 1"H	229	249
340MB	IDE	CP30344	13ms	3.5" 1"H	339	359
340MB	SCSI	CP3034Ø	13ms	3 5" 1"H	369	519
545MB	IDE	CP3Ø544	10ms	3.5" 1"H	649	669
545MB	SCSI	CP3O54Ø	10ms	3.5" 1"H	699	849
1370MB	SCSI	CP3137Ø	10ms	3 5" HH	1,099	1,249
FUJITSU						
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520MB	SCSI	FJ2624S	12ms	3 5" HH	569	719
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1750MB	SCSI	FJ2652S	11ms	5.25" FH	2,199	2,349
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250MB	IDE	MX7245A	15ms	3 5" 1"H	219	239
250MB	SCSI	MX7245S	15ms	3 5" 1"H	249	399
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340MB	SCSI	MX7345S	12ms	3 5" HH	349	499
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540MB	SCSI	MX54OS	12ms	3 5" 1"H	759	909
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127MB	SCSI	QUELS127S	17ms	3.5" 1"H	199	349
170MB	IDE	OUELS1O5ØA	17ms	3 5" 1"H	199	219
170MB	SCSI	OUELS1Ø5ØS	17ms	3.5" 1"H	199	349
240MB	IDE	OULPS24ØA	9ms	3 5" 1"H	239	259
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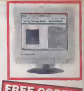

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PC Computing FREE PRODUCT INFORMATION

Circle the numbers below corresponding to products featured in this issue's advertisements and listed in the Editorial Product Index. Manufacturers will mail product literature to you free of charge.

Void after June 30, 1994

PRODUCTS FEATURED IN ADVERTISEMENTS

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Please answer questions below:

1. **Where do you use your computer?** (Check one only)
   A ☐ Home B ☐ Business C ☐ Both
2. **What kinds of computers do you use?** (Check all that apply)
   D ☐ IBM/Compatible Laptop E ☐ IBM/Compatible Desktop F ☐ MAC
3. **Do you plan to buy any of the hardware or software mentioned below in the next three months?** (Check all that apply)

HARDWARE
G ☐ PC
H ☐ MAC
I ☐ Laptop
J. ☐ Printer
K. ☐ Monitor
L ☐ Disk/Tape Back-up
M. ☐ Add-in Board
N. ☐ Modem
O. ☐ Input Device
P. ☐ Local Area Network

SOFTWARE
Q. ☐ Accounting
R ☐ Spreadsheet
S ☐ Personal Finance
T ☐ Desktop Publishing
U ☐ Word Processor
V ☐ Database Manager
W ☐ Graphics
X. ☐ Utility
Y ☐ Communications
Z ☐ Windows/Multi-tasking
1 ☐ Programming Language/Compiler
2 ☐ Integrated/Multifunction
3 ☐ CAD

4. **From which of the following sources do you purchase personal computer products?** (Check all that apply).
   4 ☐ Specialty Computer Retail Stores 6 ☐ Direc from Manufacturers
   5 ☐ Mail Order Firms 7. ☐ Other

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5. ☐ Please send me a one-year (12 issue) subscription to PC/Computing for $16.94. (U.S. price); all other countries add $16.00 for additional postage.

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R. ☐ Spreadsheet
S. ☐ Personal Finance
T. ☐ Desktop Publishing
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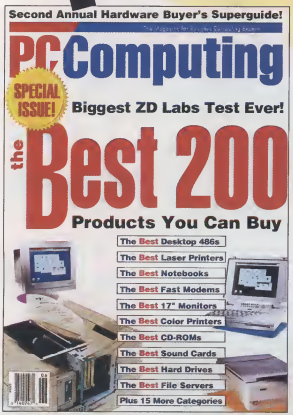

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486SLC2-66/64C VLB	$250	$410	$656	$766	$866	$956	$1,016	$1,086
486SLC2-50/64C VLB	226	386	626	736	786	626	986	1,056
486SX2-66C VLB	458	616	856	966	966	1,156	1,216	1,286
486DX-50/128C VLB	466	646	686	896	1,026	1,166	1,246	1,316
486DX2-50/128C VLB	346	566	746	856	986	1,046	1,106	1,176
486DX-33C VLB	312	472	710	626	656	1,016	1,076	1,146
486DLC-40/128C VLB	156	326	566	676	706	866	926	996
486DX2-66/128C NICE EISA W/LB	586	766	1,006	1,116	1,146	1,306	1,366	1,436
486DX-50/128C NICE EISA W/LB	626	786	1,026	1,146	1,176	1,336	1,396	1,466
486DX2-50/128C NICE EISA W/LB	466	656	896	1,006	1,036	1,196	1,256	1,326
486DX-33/128C NICE EISA W/LB	408	656	896	1,006	1,036	1,196	1,256	1,326
486DX2-66C ISA	446	606	846	956	986	1,146	1,206	1,276
486-66/128C ISA	470	636	876	986	1016	1,176	1,236	1,306
486DX2-56/128C ISA	346	566	746	856	886	1,046	1,106	1,176
486DX-40/128C ISA	322	486	726	836	866	1,026	1,086	1,156
486DX-33C ISA	316	482	700	616	646	1,066	1,060	1,136
486SX-33C ISA	104	324	562	672	702	862	922	992
486SX-25C ISA	132	284	532	642	672	832	882	962
486DLC-40/64C ISA	144	384	542	652	682	842	902	972
386DX-40/64C	182	284	562	612	642	802	862	932
386SX-40	72	234	472	582	612	772	832	902
386SX-33	66	226	466	576	606	766	826	896

***BASIC SYSTEM CONFIGURATION:** Motherboard & CPU, 1MB memory, IDE 2HD/2FD controller w/2S/1P/1G, 1.2MB or 1.44MB Floppy Drive, Internal Clock/Calendar, Enhanced Case with Power Supply, and 101-Key Enhanced Keyboard.

LOCAL BUS STOP

Pentium P5-60 VLB $1,998
486DX2-66 / DX-50 .....$1,278 / 1,248
486DX2-50 / DX-33 .....$1,128 / 1,118
486SLC2-66 / SLC2-50.....$1,048 / 998

- Local Bus Motherboard
- Local Bus SVGA Card w/1MB
- 64K External Cache
- 120MB IDE Hard Drive
- 4MB RAM
- 1.2MB Floppy Drive
- 1.44MB Floppy Drives
- 101-Key Enhanced Keyboard
- 14" SVGA Monitor (.28DPI)
- VLB IDE 2HD/2FD Controller
- 2S/1P/1G Port
- Desktop or Mini Tower Case w/PS

BEST PRICES IN THE WORLD

- 4MB RAM INSTALLED
- 120MB HARD DRIVE
- 1.44 FLOPPY DRIVE
- 1 SERIAL / 1 PARALLEL
- BUILT-IN TRACKBALL
- BATTERY PACK
- CARRYING CASE
- MS DOS 6.2

Best Buy	VGA Mono	Dual Scan Color	Active Matrix Color
486SX-25	$1,335	$2,025	$2,795
486SX-33	1,395	2,085	2,845
486DX-33	1,485	2,175	2,995
486DX2-50	1,585	2,285	3,045
486DX2-66	1,685	2,385	3,215

OPTIONS

- Upgrade to 8MB RAM .....Add $268
- Upgrade to 20MB RAM .....Add $1,548
- 200MB Hard Drive.....Add $128
- 340MB Hard Drive.....Add $328
- Internal Battery Pak.....Add $94
- Internal Fax Modem .....Add $128
- Pocket Fax Modem.....Add $118
- Docking Station.....Add $368

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212mb 16ms / 250mb14ms(IDE) .194 / 214
340mb 15ms / 540mb12ms (IDE) .264 / 464
200mb 16ms (SCSI) 244
340mb 13ms (SCSI) 348
540mb 12ms (SCSI) 484
1.2GB 13ms (SCSI) 848
2.0GB 13ms (SCSI) 1,128

MATH COPROCESSORS

80287-10 ..... $40
387SX-33 / 25 ..... 50 / 48
387DX-40 / 33 ..... 54 / 52

PRINTERS

Citizen uSX-190 (9-Pin) $158
Citizen GSX-230 / 240 (24-Pin) ... 248 / 298
Citizen GSX-145 (24-Pin) 378
Color Option for Citizen Printer ..... 46 / 66
Panasonic KX-P1150 / 2023 ..... 138 / 198
Panasonic KX-P2123 / 2124 ..... 218 / 316
Panasonic KX-P1624 / 2624 ..... 376 / 396

KEYBOARDS

101 Enhanced Keyboard (Mitsumi) $16
Maxiswitch / Keytronics ..... 28 / 30
MaxiPro II (124 Key Programmable) 48
Focus 2001 / 7000 (w/Trackball) ..... 36 / 54
Focus 8000 (w/Calculator) / 9000 ..... 48 / 58
Omnikey 101N1 / 102 / Ultra ..... 68 / 68 / 98

VIDEO CARDS AND MONITORS

VGA 256K / 512K ..... $28 / 38
1MB SVGA Card (1024*768*256) 56
Windows Accelerators w/1MB 58
Trident / Cirrus Logic w/1MB (VLB) ...79 / 76
Genoa 8500 VLB w/1MB 98
ATI Graphic Ultra w/Mouse 154
ATI Graphic Ultra Plus w/2MB 226
ATI Graphic Ultra Pro w/2MB 320
ATI Graphic Ultra Pro VLB w/2MB 324
Diamond Speed Star Pro VLB / ISA 136
Diamond Stealth 24VLB w/1MB 146
Diamond Viper VLB w/2MB 368
Orchid Fahrenheit 1280+ w/1MB 138
Orchid Fahrenheit VLB w/1MB 148
Orchid Celsius VLB: 1MB / 2MB ... 204 / 268
MAG 15F (15") / 17F (17") ..... 494 / 670
Nanao F340w / F550w ..... 544 / 1,098
Nanao T560 / T660 ..... 1,656 / 2,398
NEC 3V / 4FGe / 5FGe ... 548 / 676 / 1,064
Sony 1430 / 1604 / 1730 ..... 548 / 926 / 974
Viewsonic 4E / 6E / 14E ..... 294 / 324 / 376
Viewsonic 15E / 15 ..... 384 / 454
Viewsonic 17G / 17 / 20 ..... 844 / 964 / 1,544
Hitachi CM-2095 (20") 1,294
14" Mono / VGA Mono ..... 80 / 100
14" VGA (640*480, 0.51) 170
14" Super VGA (1024*768, 0.39) 198
14" Super VGA (1024*768, 0.28) 220
14" Super VGA (1024*768, 0.28) MI 240
15" Super VGA (1280*1024, 0.28) 334
17" Super VGA (1280*1024, 0.28) 594

CD ROM / MULTIMEDIA

Creative Sound Blaster Pro Deluxe 110
Mediavision Pro Audio Spectrum 16 138
Mitsumi or SONY CD-ROM w/Card 140
Panasonic CD-562 Dbl. Speed w/card 198
Chinon CD533S (SCSI) Internal 324
Toshiba XM-3401B 200ms (SCSI) 338
Trantor (SCSI) Host with Driver 50
Creative Edutainment CD16 Upgrade Kit .466
Speakers System 10

HARD/FLOPPY DRIVE ADAPTERS

IDE 2FD/2HD Cache Controller (OK) $88
Vesa Local Bus IDE 78
Adaptec SCSI 1542CF / 1542CFR ... 178 / 235
Adaptec SCSI 2742TK (EISA) 366
Bustek SCSI 445S (VLB) 275

MISCELLANEOUS

2400 Modem 28
Fax Modem (9600 Fax, 2400 Modem) 40
Fax Modem (14,400 Fax, 14,400 Modem) .112
US Robotics 14,400 FM Int / Ext ... 150 / 168
3-Button Mouse 9
Logitech Mouseman Serial / Bus ..... 50 / 62
Microsoft Mouse Serial / Bus ..... 36 / 58
Connner Tape Backup 250MB 130
Colorado Tape Backup DJ-10/20 ..... 98 / 160
Colorado Trakker JT-20 (250MB) Ext 338
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WE WILL BEAT ANY LEGITIMATE PRICE QUOTED BY A COMPETITOR IN THIS ISSUE.

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Seagate

FACTORY NEW – FULL WARRANTY

IDE		
130MB ST3144A	15MS 3 5X1"	$ 189
12BMB ST9145AG	16MS 2 5"	299
260MB ST3290A	16MS 3 5X1"	248
340MB ST3390A	12MS 3 5"	309
209MB ST9235AG	16MS 2 5"	399
452MB ST3550A	12MS 3 5X1"	416
540MB ST3655A	12MS 3 5"	535
SCSI		
457MB ST3550N SCSI-2	12MS 3 5X1"	520
525MB ST3600N SCSI-2	11MS 3 5X1"	625
343MB ST3390N SCSI-2	12MS 3 5X1"	399
1420MB ST41650N	15MS 3 5X1"	1121
1350MB ST41600N	12MS FH	1625
1 2GB ST11200N SCSI-2	12MS 3 5"	953
1 2GB ST41200N	14MS FH	995
1 6GB ST41651	15MS FH	1167
2 1GB ST42100N SCSI-2	14MS FH	1429
2 1GB ST42400 SCSI-2	11MS FH	1769
3 55GB ST43400N SCSI-2	10MS FH	2250
1 7GB BARRACUDA-I ST11950N SCSI-2	3 5"	1655
2.1GB BARRACUDA-II ST12550N SCSI-2	3 5"	2025
2 2GB ST12400N SCSI-2	12MS 3 5"	1745

Maxtor

FACTORY NEW – FULL WARRANTY

IDE		
130MB 7131A	14MS 3 5X1"	189
213MB 7213A	15MS 3 5X1"	232
245MB 7245A	15MS 3 5"	245
345MB 7345A	15MS 3 5"	299
SCSI		
345MB 7345S SCSI-2	12MS 3 5"	385
540MB 540S	8MS 3 5X1"	608
1 2GB 1240S SCSI-2	BMS 3 5"	1325

CONNER

FACTORY NEW – 1 YEAR WARRANTY

IDE		
170MB CP30174E	17MS 3 5X1"	$ 207
212MB CP30204	12MS 3 5X1"	225
250MB CP30254H	14MS 3 5"	249
340MB CP30344	14MS 3 5X1"	299
540MB CP30544	10MS 3 5X1"	645
SCSI		
212MB CP30200	12MS 3 5X1"	253
540MB CP3540 SCSI-2	10MS 3.5"	615
1GB CP1060S SCSI-2	10MS 3 5"	955

WESTERN DIGITAL

FACTORY NEW – 2 YEAR WARRANTY

IDE		
212MB WD2200	12MS 3 5X1"	$ 225
250M6 WD2250	14MS 3 5X1"	242
340MB WD2340	12MS 3 5X1"	295
420MB AC2420	13MS 3 5X1"	370
540MB WD2540	11MS 3 5X1"	495

TOSHIBA

5 YEAR WARRANTY ON 3 5"
1 YEAR WARRANTY ON 2 5"

SUPERFAST SCSI-2		
130MB N/A	17MS 2 5"	$329
200MB IDE MK2224	17MS 2 5"	418
200MB SCSI MK2224	17MS 2 5"	439
340MB IDE MK2326	2 5"	588

1 x 9 $48
4 x 9 $154
70 NS SIMMS

4MB X 9-80NS SIMM-PC	147	256K X 9-100NS SIMM	13	1MB X 9-70NS SIPP	53
4MB X 9-70NS SIMM	154	256K X 9-80NS SIMM	14	1MB X 9-60NS SIPP	56
4MB X 9-60NS SIMM	160	256K X 9-70NS SIMM	15	256K X 9-100NS SIPP	18
1MB X 9-100NS 9 CHIP SIMM	44	256K X 9-60NS SIMM	18	256K X 9-80NS SIPP	19
1MB X 9-80NS 3 CHIP SIMM	42	1MB X 8-80NS SIMM	42	256K X 9-70NS SIPP	20
1MB X 9-80NS 9 CHIP SIMM	47	1MB X 8-70NS SIMM	43	256K X 9-60NS SIPP	23
1MB X 9-70NS 3 CHIP SIMM	42	4MB X 8-80NS SIMM	140	256 X 36 – 1MB	56
1MB X 9-70NS 9 CHIP SIMM	48	4MB X 8-70NS SIMM	147	512 X 36 – 2MB	88
1MB X 9-60NS 3 CHIP SIMM	44	1MB X 9-100NS SIPP	49	1 X 36 – 4MB	185
1MB X 9-60NS 9 CHIP SIMM	50	1MB X 9-80NS SIPP	52	2 X 36 – 8MB	375
1MB X 9-53NS 3 CHIP SIMM	50			4 X 36 – 16MB	695
1MB X 9-53NS 9 CHIP SIMM	53				
16MB X 9-70NS SIMM	720				

MOTHER BOARDS

OPTI	
386DX-33-64K CACHE W/CPU	188
386DX-33-256K CACHE W/CPU	249
386DX-40-64K CACHE W/CPU	210
386DX-40-256K CACHE W/CPU	260
486SX-25-64K CACHE W/CPU	349
486DX-33-64K CACHE W/CPU	490
486DX-33-256K CACHE W/CPU	540
486DX-50-256K CACHE W/CPU	749
FREE	
486DX-33 128K CACHE	537
486DX-50 256K CACHE	740
486DX-33 8-ISA,2-VESA 256K CACHE	488
486DX2-66 8-ISA,2-VESA 256K CACHE	594
OCEAN	
JAGUAR 386DX 40 128K	138
HIPPO 486DX-33 ISA 256K"Dynamic Cache"	448
HIPPO 486DX-50 ISA 256K"Dynamic Cache"	809
JAGUAR IV 486DLC-40 128K Math Co	318
JAGUAR VESA486DX-33 256K 2-VLB"Dynamic Cache"	598
AMERICAN DIGICOM	
486SX-25 ISA 128K	249
486DX2-66 ISA 128K	809
486DX-33 VESA 256K	468
486DX2-66 VESA 256K	729
SILICON STAR	
386DX-40 128K Cache	159
486DX-33 ISA 128K Cache	428
486DX-33 VESA 256K Cache	478
486DX-33 EISA 256K Cache	534
RICS Made in U.S.A.	
486DX-33 8-ISA, 2-VESA LB 256K	488
MINI 486DX-33 5-ISA, 3-EISA, 2-VESA LB 256K	578
MINI 486DX2-66 5-ISA 3-EISA, 2-VESA LB 256K	838
486DX2-66 6-EISA 2-ISA 1 Meg Cache	1178
SUPER EISA 486DX2-66 8-EISA 1-VESA LB 512K	1088
A.I.R. Made in U.S.A.	
486DX-33 8-ISA, 3-VESA 256K P24T Socket	548
486DX2-66 8-ISA, 3-VESA 256K P24T Socket	808
486DX-33 8-ISA, 3-VESA 256K	799
486DX2-66 8-ISA 3-VESA 258K	1040
VEGA Made in U.S.A.	
3/486DX-33 VESA 2-VL 256K ZIF MULTI I/O IDE	818
3/486DX-33 VESA 3-VL 256K,ZIF	489
486DX-550 ISA 256K	459
486DX2-66 3-VESA 256K	788
MICRONICS (U.S.A.)	
MX-30 486DX-33 VESA 256K	668
MX-30 486DX2-50 VESA 256K	888
GEMINI 486DX-33 VESA 256K	785
GEMINI 486DX2-66 VESA 256K	1248
MYLEX (U.S.A.)	
486DX2-66 256K MULTI I/O	1018
486DX-50 EISA 256K MULTI I/O	1238
486DX2-66 VESA 64K MULTI I/O	1048
486DX2-66 EISA/VESA 256K MULTI I/O	1288
AMI Made in U.S.A.	
SUPER VOYAGER LC 486DX-33 256K	878
SUPER VOYAGER 486DX-33 VESA 2-VLB 256K	508
SUPER VOYAGER 486DX2-66 VESA 2-VLB 256K	1258
ENTERPRISE III VLB 486DX2-66 256K	1378

Quantum

FACTORY NEW – 2 YEAR WARRANTY ELS & LPS
5 YEAR WARRANTY ON P. DRIVES
1 YEAR WARRANTY ON 2.5" DRIVES

CAPACITY M/N	SPEED SIZE	PRICE
IDE		
127MB ELS127A	17MS 3 5X1"	$181
170MB ELS170A	17MS 3 5X1"	188
240MB ELS270A	16MS 3 5X1"	249
525MB LPS540A	10MS 3 5X1"	495
SCSI		
127MB ELS127S	17MS 3 5X1"	184
170MB ELS170S	17MS 3 5X1"	195
270MB LPS270S	16MS 3 5X1"	252
540MB LPS540S SCSI-2	10MS 3 5X1"	495
1GB P10B0S SCSI-2	10MS 3 5X1"	908
1 2GB P1225S SCSI-2	10MS 3 5"	985
1.8GB P1800S SCSI-2	10MS 3 5"	1085

FUJITSU

FACTORY NEW – 5 YEAR WARRANTY

SCSI		
1 2GB M2694SA	10MS 3 5"	$885
2 4GB M2654SA	12MS FH	1415

MICROPOLIS

FACTORY NEW – 5 YEAR WARRANTY

IDE		
976MB 2210A	10MS 3.5"	$860
1 6GB 2217A	10MS 3 5"	1185
SCSI-2		
976MB MC2210 SCSI-2	10MS 3 5"	860
1 2GB MC1598 SCSI-2	15MS FH	811
1 6GB MC1908 SCSI-2	10MS FH	1259
1 75GB MC2217 SCSI-2	10MS 3 5"	1185
2 0GB MC1548 SCSI-2	14MS FH	1173
2 1GB MC1926 SCSI-2	11MS 3 5"	1489
2 4GB MC192 SCSI-2	11MS FH	1489
3 6GB MC1936 SCSI-2	11MS FH	2145

SAMSUNG

FACTORY NEW – FULL WARRANTY

IDE			
120MB 3062	17MS	3 5X1"	189
250MB 3125	15MS	3 5X1"	235

digital

FACTORY NEW – FULL WARRANTY
DISK DRIVES FOR POWER USERS

SCSI-II			
1 0GB 3107S	9 5MS	3 5"	$909
1 6GB 3160S	9 5MS	3 5"	1231
2 0GB 5200S	12 5MS	FH	1187
3 5GB 5350S	11 5MS	FH	2517

HEWLETT PACKARD

FACTORY NEW – 5 YEAR WARRANTY

CAPACITY M/N	SPEED	SIZE	PRICE
SCSI			
1 0GB C2247	10MS	3 5"	$1145
1 0GB C97558	13MS	FH	1395
1 BGB C3009	11 5MS	FH	1995
2 0GB C3010	11 5MS	FH	2295
2 1GB C2490	8 9MS	3 5"	2295

DYNAMIC RAMS

1MB X 1 100NS	CALL
1MB X 1 80NS	CALL
1MB X 1 70NS	CALL
1MB X 1 80NS	CALL
256K X 1 150NS	CALL
256K X 1 120NS	CALL
256K X 1 100NS	CALL
1 x 4-80NS DIPP	CALL
256 X 1 80NS	CALL
256K X 1 70NS	CALL
256K X 1 60 NS	CALL
256K X 4 100NS	CALL
256K X 4 80NS	CALL
256K X 4 70NS	CALL
256K X 4-60NS	CALL
64K X 4 120NS	CALL
64K X 4 100NS	CALL
64K X 4-80NS	CALL
64K X 1 150NS	CALL
64K X 1 120NS	CALL
64K X 1 100NS	CALL

CACHE

8 X 8 15	5 00
32 X 8 15	16 00
8 X 8-25	4 00
32 X 8 25	7 00
64 X 4 25	8 00
16 X 4 25	6 00
8 X 8-20	4 50
32 X 8-20	8 00
64 X 4 20	10 00
16 X 4 20	8 00
16 X 4 15	6 00
64 X 1 20	10 00
64 X 1 15	00 00

MATH CO-PROCESSORS

INTEL	
8087 5MHZ INTEL	40.00
8087 2 8MHZ INTEL	100.00
8087 1 10MHZ INTEL	00.00
80287-6 6MHZ INTEL	40.00
80287 8 8MHZ INTEL	40.00
80287 10 10MHZ INTEL	00 00
80287XL 10MHZ INTEL	75 00
80387XLT 12MHZ INTEL	75.00
80387SX 16 16MHZ INTEL	75.00
80387SX 20 20HZ INTEL	75.00
80387SX 25 25HZ INTEL	75.00
80387DX 16 16MHZ INTEL	75.00
80387DX 20 20MHZ INTEL	75.00
80387DX 25 25MHZ INTEL	75.00
80387DX 33 33MHZ INTEL	75.00
80487SX 25 INTEL	375 00
OVERDRIVE SX DX33	CALL
OVERDRIVE SX DX25	CALL
OVERDRIVE SX DX20	CALL
RAPID CAD	CALL
CYRIX	
83D87DX 16 16MHZ CYRIX	75 00
83D87DX 20 20MHZ CYRIX	75.00
83D87DX 25 25MHZ CYRIX	75.00
3D87DX 33 33MHZ CYRIX	75 00
83D87DX 40 40MHZ CYRIX	00 00
83S87SX16 16MHZ CYRIX	00.00
83S87SX20 20MHZ CYRIX	00.00
83S87SX25 25MHZ CYRIX	00.00
82S87XL CYRIX	00 00
WEITEK	
3167 20MHZ WEITEK	285.00
3167 25MHZ WEITEK	385 00
3167 33MHZ WEITEK	485 00
4167 25MHZ WEITEK	445 00
4167 33MHZ WEITEK	885 00
IIT	
2C87-8 8MHZ IIT	54.00
2C87 10 10MHZ IIT	54 00
2C87 12 12MHZ IIT	00.00
2C87 20 20MHZ IIT	64 00
3C87 16 16MHZ IIT	00.00
3C87 20 20MHZ IIT	00.00
3C87 25 25MHZ IIT	00.00
3C87 33 33MHZ IIT	00.00
3C87-40 40MHZ IIT	75.00
3S87SX 16 16MHZ IIT	00.00
3S87SX 20 20MHZ IIT	00 00
3S87SX 25 25MHZ IIT	00.00
3S87SX-33 33MHZ IIT	00.00

INTEL CPUs

386 DX	
80386 DX/20	00
80386 DX/25	74
80386 DX/33	00
AMD DZ40	00
486DX/SX	
80486 DX/25	290
80486 DX33	008
80486 DX/50	496
80486 DX 2/50	478
80486 DX 2/66	008
80486 SX/25	178
80486 SX/20	100
80486 SX/33	240

PS 2 HARD DRIVES

PS/2 00 50Z 55SX 60 70 80 P70

INTERNAL DRIVE KITS May be used as a high performance replacement or to co-exist with the original IBM drive. Compatible with DOS 3 3 4 01 5 0 OS/2 2 0 and Novell. Includes IDE or SCSI 2 microchannel controller hard drive mounting kit ribbon and power cable manual and hardware

106MB 15MS IDE	303
125MB 15MS IDE	414
125MB 15MS SCSI	430
200MB 15MS IDE	453
200MB 15MS SCSI	613
340MB 13MS IDE	509
340MB 13MS SCSI	000
512MB 12MS IDE	1043
512MB 12MS SCSI	1204
1 2GB 12MS SCSI	1443

PS/2 MODEL 25 00, 30-286

INTERNAL DRIVE KITS Includes controller drive mounting kit cables and hardware Supports DOS 5 0 Windows 3 1

42MB HARD DRIVE KIT	100
106MB HARD DRIVE KIT	200
125MB HARD DRIVE KIT	204
200MB HARD DRIVE KIT	323
MICROCHANNEL CONTROLLER	
IDE	100
SCSI 2	170

IDE CONTROLLER supports all internal IDE drives. Zero slot installation for model 50 & 50Z
SCSI 2 CONTROLLER supports 7 internal or external SCSI drives. CD Roms & Tape Backups with 7 year warranty! Both support DOS 5 0 Windows & OS/2 compatible with existing IBM drive and controllers

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WORLDWIDE TECHNOLOGIES 437 Chestnut Street, Philadelphia, PA 19106 Customer Service 215-922-4640

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BEWARE OF LOW PRICED THIRD PARTY IMITATION 1x9 AND 4x9 SIMMS
WHY BUY ANYWHERE ELSE? CALL US!!

Circle 251 on reader service card.

"What to do when Windows™ won't work."

INCREASE SPEED

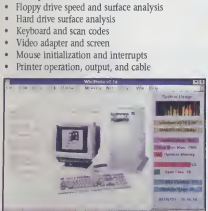
WINProbe uncovers the secrets to faster Windowsoperation. Simply click your mouse on "Tune Up" and **WINProbe** analyzes your system, then gives you up to 35 suggestions on how to speed up your system...

- Analyzes SmartDrive settings to improve hard drive performance
- Identifies and explains how to set up a permanent swap file
- Identifies which mode is best, Standard or Enhanced
- Pinpoints the optimum driver for your VGA card
- Optimizes and frees fragmented memory
- Analyzes and suggests the best Windows setup for your system

TROUBLESHOOT YOUR OWN PC

Few things are more aggravating than computer downtime and lockups. You waste time waiting for help and usually pay a dear price to get it when you finally do. Your time is valuable, so let **WINProbe** troubleshoot the problem for you. You'll be able to quickly identify the source of the problem; hardware, software, or configuration. Telephone support time is slashed. Repair bills drop like a rock (50% and more of your repair bills are for diagnosing the problem, **WINProbe** does it for you at NO COST!). Tests include...

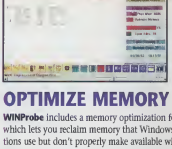
- CPU and system board in 16 and 32 bit operation
- Math coprocessor
- Memory; conventional, extended, expanded, and XMS
- COM ports and MODEM control lines
- Floppy drive speed and surface analysis
- Hard drive surface analysis
- Keyboard and scan codes
- Video adapter and screen
- Mouse initialization and interrupts
- Printer operation, output, and cable



RESOLVE SETUP PROBLEMS

Say 'goodbye' to software and hardware configuration and setup problems. **WINProbe** provides helpful information on...

- Installing a new hard drive
- CMOS display and edit
- IRQ, DMA, and UMB usage
- What to do when installing an add-in card
- Cleaning up *.INI and *.GRP files
- Memory allocation and management
- Locating and removing duplicated system files



OPTIMIZE MEMORY

WINProbe includes a memory optimization feature which lets you reclaim memory that Windows applications use but don't properly make available when you're in another program. Now you can avoid system crashes and other problems caused by reduced available memory.

COMPATIBILITY

WINProbe requires an IBM AT, 386, 486, PS/2 or compatible with at least 1MB of RAM, DOS 3.1 or higher, Windows 3.0 or higher, and either a Hercules mono, EGA, VGA, or SVGA video. A mouse is recommended but not required.

BUY WINPROBE OR BUY THE BUNDLE

WINProbe is available by itself or in a special bundle with **PC Certify**, Landmark's DOS troubleshooting software and **Landmark DOS for Windows**, the remarkable DOS-like operating shell for Windows.

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SOFTWARE ETC

ENVISIONS' HANDHELD SCANNERS *DEFINE* VALUE!

Features and Bundled Items:	ENVISIONS ENV256™	Logitech ScanMan®256	ENVISIONS ENVColor™	Logitech ScanMan®Color
Resolution	Up to 400 dpi	Up to 400 dpi	Up to 800 dpi	Up to 400 dpi
Greyscales/Color Capability	256 Greyscales	256 Greyscales	16.7 Million Colors	16.7 Million Colors
Automerge/AutoStitch	✓	✓	✓	✓
Image Editing Software included	Halo Desktop Imager PC Magazine's Editors' Choice	FotoTouch by Logitech	Halo Desktop Imager PC Magazine's Editors' Choice	FotoTouch by Logitech
Text Scanning Software included	Perceive Personal	Catchword Pro by Logitech	Perceive Personal	Available at additional cost
Your Price	$149.00	$279.99*	$299.00	$524.99*

*Average of 3 prices quoted by Egghead Software stores in the San Francisco Bay Area on 12/20/93. Handscanner bundles require 386 or higher, Windows 3.1, 4MB RAM, 5MB hard disk space free

ENVISIONS
Scanner Solutions Made Easy

Envisions' bundles are still more logical than Logitech's *by far!*

Let's be reasonable – both Envisions and Logitech offer terrific handheld scanners bundled with premium software to scan text and graphics. They both scan full pages using automerge technology. But why does Logitech make you pay so much more? We can't figure it out either. It's not logical!

What's the difference between these scanned photos?

Sure, the Logitech ScanMan™ Color delivers a nice scanned image, but are you prepared to spend an extra $276 for the Logitech name? When you grab an ENVColor scanner, you get a complete scanning solution for text and graphics, all for hundreds less than Logitech!

Photo scanned with Envisions' $299 ENVColor handheld scanner at 400 dpi in 24-bit color.

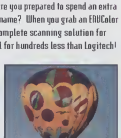

Photo scanned with Logitech's $525 ScanMan™ Color handheld scanner at 400 dpi in 24-bit color.

Envisions' handheld scanner bundles include imaging and text scanning software!

Automatically Merge Multiple Scans and Create Posters!

HALO Desktop Imager brings full page imaging power to your handheld scanner!

- Automerging assembles multiple scans easily
- Preview mode takes guesswork out of fine-tuning
- Blow up an image to 10,000% using minimal disk space
- Batch file conversion feature
- Gallery Image File Manager lets you see saved files before opening

June 16, 1992
HALO Desktop Imager

Retail Value $169

"HALO Desktop Imager is a useful no-strings-attached high-end features designed on a low priced package."
–Seybold Report on Desktop Publishing

Scan Text Off the Page for Quick, Accurate Data Entry!

Perceive Personal 2.0's new accuracy and speed saves time and effort when scanning text.

Perceive 2.0 recognizes a variety of text styles and sizes. There's no need to re-type, ever! Plus, this new version self-installs to save you even more time and effort.

- Recognizes 6-24 point type without training–even mixed fonts on the same page!
- Up to 99.8% accuracy, eliminates tiresome corrections
- Recognition speed for a full page of text is a fast 15-40 seconds, based on performance of a 386/33MHz PC with 4 MB of RAM

Retail Value $299

Now! Connect your handheld scanner to your laptop computer!

Now you can capture text and images on the go with a special accessory called the **ENV LPT Adapter** that connects your handheld grayscale scanner to your laptop computer through the printer port. It's fully Twain-compliant to work seamlessly with all your Twain-based applications!

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Envisions Solutions Technology, Inc., 822 Mahler Road, Burlingame, CA 94010

ENVColor Scanner Bundle
800 dpi color scanner plus bundled software Part# EST-4460B — ONLY $299

ENV256 Scanner Bundle
400 dpi grayscale scanner plus bundled software Part# EST-4530B — ONLY $149

- Halo Desktop Imager $169
- Perceive Personal OCR $299

Total Software Value.....$468 — FREE WITH SCANNER

MICROSOFT WINDOWS · TWAIN Compatibility · FEDERAL EXPRESS · 30 DAY MONEY-BACK GUARANTEE · Restocking fees may apply · One Year Warranty!

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Are you looking for an excellent scanner for desktop publishing? Save yourself some time. Scan the value you get with Envisions' total DTP scanning solutions. This is an unbeatable value in software, bundled with our award-winning Best Buy scanners.

Adobe Photoshop™ 2.5 for Windows image editing software has taken desktop publishing to the high end. Photoshop offers extensive features for creating original art, editing and enhancing scanned images, color separating and importing renderings from other applications.

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Kai's Power Tools™ now Windows version offers 33 awesome plug-in filters for Photoshop and other programs. Transform your images with textures, backgrounds, gradients, glows, halos, metallic tubes and more for a creative explosion! Based on the award winning Mac version.

Ofoto™ for Windows fully automates the grayscale adjustment process simply by using the specified printer's requirements. In just one step, you can achieve the maximum quality in any grayscale image even if you don't have a trained photographer's eye!

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ONLY $1299 — Part# EST-3057B

ENV8100 DTP Scanner Bundle

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- Microsoft Publisher — $ 199
- KAI Power Tools — $ 199
- OFOTO for Windows — $ 395

Total Software Value.....$ 1688

Envisions 800/1600 dpi scanner plus software bundle is only $1299

ONLY $1799 — Part# EST-3058B

ENV24Pro DTP Scanner Bundle

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- KAI Power Tools — $ 199
- OFOTO for Windows — $ 395

Total Software Value.....$ 1688

Envisions 1200/2400 dpi scanner plus software bundle is only $1799

Pictured: ENV24Pro with optional $699 transparency adapter.

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ENVISIONS — Scanner Solutions Made Easy

Envisions flatbed scanners and bundled software require 386 or higher, Windows 3.1, 4 MB RAM, 20 MB hard disk space free, ISA slot available for interface card (included). PS/2™ and Apple™ Macintosh versions are also available.

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The days of retyping documents are over! Now you can completely automate tedious retyping, filing and organizing chores with Envisions' office automation scanner bundle! This is all you need to free yourself from wasteful hours of manually inputting data.

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Lotus Organizer™ is an on-screen calendar, to-do list, planner, address book, notepad and reminder all rolled into one. Use it to set up meetings with anyone on your LAN or WAN via cc: Mail.

Recollect™ document image management software lets you spend more time using your information and less time looking for it. Capture, store, recall and manage documents.

CardScan™ business card scanning software (not pictured) organizes all your crucial business contacts. One button scanning, auto sort and file, automatically dials the phone number you need! It keeps an image of the card for reference. It's like a terrific assistant!

Halo Desktop Imager™ See details on page 3 of this ad

Envisions Award-Winning Scanners

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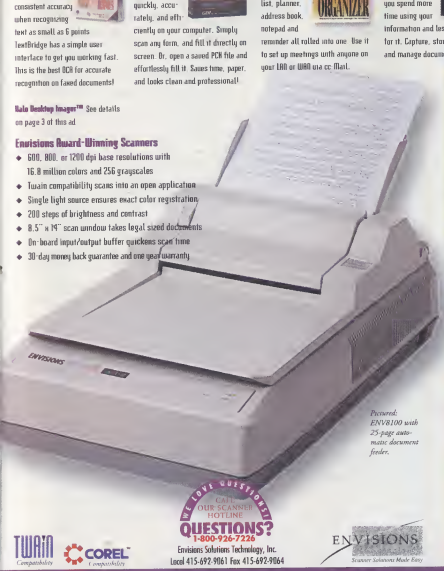

Pictured: ENVR100 with 25-page automatic document feeder.

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ENV800 Office Scanner Bundle

Auto Document Feeder	$ 399
TextBridge OCR	$ 99
Recollect	$ 795
ScanType	$ 129
CardScan	$ 149
Lotus Organizer	$ 149
Halo Desktop Imager	$ 169
Total Software Value	$ 1889

Envisions 800/1600 dpi scanner plus software bundle is only $1499

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ENV24Pro Office Scanner Bundle

Auto Document Feeder	$ 399
TextBridge OCR	$ 99
Recollect	$ 795
ScanType	$ 129
CardScan	$ 149
Lotus Organizer	$ 149
Halo Desktop Imager	$ 169
Total Software Value	$ 1889

Envisions 1200/2400 dpi scanner plus software bundle is only $1999

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The next release of Windows.

142 ..... Cutting-Edge Multimedia 898
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160 ..... Face-Off: Word Processors 899
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188 ..... DSP: The Secret Is Out! 900
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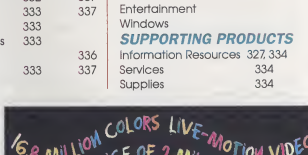

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Arcadia Workplace Companion

by Arcadia Technologies, Inc.

"A PIM with a Twist: This One's for OS/2 (PC Magazine, September 28, 1993)." Yes, the Arcadia Workplace Companion is a native 32-bit and complete personal information manager (PIM) software designed specifically as an integrated part of the OS/2 Workplace Shell environment.

$149

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$795

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OS/2-PREMIER

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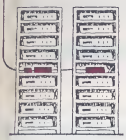

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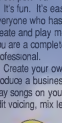

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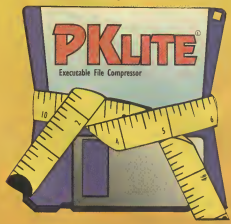

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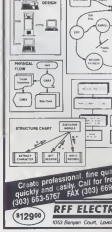

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I DO ALEX BENNETT'S morning radio program whenever I'm in San Francisco. He's on the short list of people who make 7 a.m. worthwhile. When I found he was also a computer/tech geek, I invited him to join the Jungle, our private BBS. For years Alex and I have been e-writing to each other, sharing jokes, ideas, feelings, opinions, and vivid details of real and imagined sexual encounters in this electronic locker room. The 18 Jungle Beaters are very close—I would take a bullet for any one of them.

I was in my beautiful City by the Bay a few months back, and Alex and I were having a wicked-decent blast on air when the producer informed us that our next guest would be Ellen Goodman, who writes a syndicated newspaper column on no particular subject. Neither Alex nor I had heard of her, but "ignorance of your culture is not considered cool," so we were eager to learn.

San Francisco is often the last stop on the literature pimping tour, and Ellie was into her groove. She was selling Amway. The book, judged by its cover (and what better way is there to judge a book on short notice?), seemed like standard middle-aged, rich-person hype—like Alan Alda writing in drag. Somehow she started doing shtick about computers and the Net. She was dancing the "high-tech/low-touch tango." Penn don't let that noise play in the background.

You all know the points I hit: Relationships on the Net are very real, based on wit and ideas through writing instead of looks and smells through hair care products. Net love stories abound, and I talked of my Net-met married friends.

She rebutted with "Could you please take off your sunglasses?" She thought it made her seem direct, earthy, and human. I thought it made her sound like my Social Studies teacher. My prescription shades were too bitchin' to lose. With Ms. Goodman, you want those greens well-filtered.

I talked of my white light/white heat love for my e-friends. She countered with "How do you bring them breakfast or get them through chemo?" What? Some jobs are better left to Denny's and medical professionals, respectively.

She bragged that she lives on an island off the coast of Maine with only 400 people and they all know each other's name and that's the way people should live. (Wow, aren't rich people great?!)

We just didn't agree. Then her column, "Interfacing with Thanksgiving" (cute) comes out (I got it on the Jungle) and she kicks it off with "I am in San Francisco sharing a radio show with Penn, wishing it were Teller." (Get it? My partner often performs silently. It's a joke.)

She drew first blood.

So, let's hear what Teller had to say: "Ellen Goodman imagines that I'd sit mutely and cutely by while she self-righteously spouts Birkenstockian drivel about electronic communication pulling us farther apart. I would not. I would go to her house and rip out her telephone and radio and television. I'd cancel her Federal Express account, lest computers assist her in tracking the last-minute birthday present she sent to Granny. And I'd enhance the personal touch on her next family vacation by shredding her nasty, computerized credit cards in her bulgur-encrusted Cuisinart."

You know, I agree with Ellen Goodman on something. I, too, wish Teller had been sitting there instead of me. ◩

ILLUSTRATION BY CATY BARTHOLOMEW

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- 3.5" 1.44MB Diskette Drive
- MS-DOS 6.2/Mouse
- Microsoft Windows for Workgroups 3.11" (or Windows 3.1)

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- PCI *9GXE Video Accelerator Card with Video Control Panel Software
- 1MB Video RAM
- VS14 Color Monitor (14", 1024 x 768, .28mm, NI)
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- 1MB Video RAM
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